

# FLIGHT

First Aero Weekly in the World.

Founder and Editor: STANLEY SPOONER.

A Journal devoted to the Interests, Practice and Progress of Aerial Locomotion and Transport.

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM.

No. 431. (No. 13, Vol. IX.)

MARCH 29, 1917.

Weekly. Price 1d.  
Post Free, 2d.

## Flight.

Editorial Office: 44, St. MARTIN'S LANE, LONDON, W.C.

Telegrams: Truditur, Westrand, London. Telephone: Gerrard 1888.

Annual Subscription Rates, Post Free.

United Kingdom .. 15s. 2d. Abroad .. .. 20s. 6d.

### CONTENTS.

	PAGE
Editorial Comment:	
Help for Crippled Flying Men .. .. .	287
"Allies' High Court" .. .. .	287
"Business Methods" .. .. .	288
Honours .. .. .	290
The Lawrence Aeroplane .. .. .	291
The Royal Aero Club. Official Notices .. .. .	292
Answers to Correspondents .. .. .	293
Aeroplane Wing-Trussing. By F. W. Pawlowski .. .. .	294
Airisms from the Four Winds .. .. .	298
Personals .. .. .	299
Aviation in Parliament .. .. .	301
The Roll of Honour .. .. .	302
The Screw Propeller in Air. By M. A. S. Riach .. .. .	303
The British Air Services .. .. .	305
Aircraft Work at the Front. Official Information .. .. .	307
The New Secretary of the Aeronautical Society .. .. .	308
Side-Winds .. .. .	308
Packing Cases .. .. .	309
Correspondence .. .. .	510
Company Matters .. .. .	310

**IMPORTANT NOTICE.**—Commencing with the issue of next week (April 5th) the price of "FLIGHT" will be 3d. per week. This action on the part of the Publishers is a necessity brought about by the restrictions placed upon the importation and manufacture of paper under the Defence of the Realm Act and the consequent unprecedented shortage of and increase in cost of paper and the various other departments in the production of "FLIGHT." We would once again urge the imperative necessity of our readers ordering "FLIGHT" to be reserved for them with their regular newsagent, or direct from the Publishers, to ensure obtaining copies regularly.

### EDITORIAL COMMENT.



IN our correspondence columns we publish a letter which embodies a most valuable suggestion. In it our correspondent, Mr. Lawson, points out that the number of wounded flying men who are crippled for life is daily increasing, and puts forward the idea that some sort of institute should be founded for the purpose of securing employment for these men who have been disabled while serving their King and country. He makes, in addition, the very handsome offer of £100 to form the nucleus of the necessary fund, and in effect asks us to undertake the work of organising it.

Help for  
Crippled  
Flying Men.

We are entirely in accord with Mr. Lawson's admirable suggestion, and we need hardly say that any assistance that can be given by "FLIGHT" will be most cheerfully and whole-heartedly accorded. But we do not conceive that the interests of so far-reaching a scheme would be best served by its being inaugurated and administered through the medium of a newspaper. It is really a matter for the Royal Aero Club and the Society of British Aircraft Constructors to take in hand and work on the same lines as the similar scheme evolved by the R.A.C. and its associated bodies for the relief and employment of disabled motor drivers and mechanics. They have both the organisation and the machinery for carrying out the idea in detail, and to them we commend it as one of the best suggestions we have seen in connection with the relief of the men who have sacrificed almost all that makes life worth living in the defence of the Empire. It is a work that is crying out to be done, and to be done without delay. As Mr. Lawson points out with a great deal of truth, unless this thing is taken in hand while the war enthusiasm is with us, the task will be a very difficult one. It would be a scandal to the great movement with which we are all identified if our gallant flying men who have been crippled in the war were allowed to tramp the country, unable to obtain the work to which their honourable wounds entitle them, for the want of the helping hand extended in time. We are certain that the sense of gratitude for services rendered, and the appreciation of what these men have done for us, is fully strong enough to ensure that that shall not be the case. To make certain it means that there must be proper organisation behind any scheme of the sort under discussion, and it is perfectly obvious that that organisation can be best undertaken by the two bodies which have a direct and official connection with the flying movement. To them we commit the idea, with the certain belief that it will receive from them the careful and sympathetic consideration it deserves.

"Allies'  
High  
Court."

Ever since, at the beginning of the war, the Germans showed themselves in their true colours, and proved by their atrocities that they rank morally below the African Bushmen, it has been accepted as a principle that punishment would be insisted upon in the case of individuals proved guilty of the ordering or commission of the misdeeds at which the whole world, civilised and uncivilised, stands aghast. Unless such principles take on a concrete form they are apt to remain merely principles, and thus we welcome



the action of a French deputy, M. Ignace, who has given expression to the feeling which is strong among the Allied nations that principle must be translated into action against the time when at last we have achieved the victory towards which we verily believe we are at last approaching. M. Ignace has initiated a motion in the French Chamber of Deputies requesting the Government, after agreement with the Allied Governments, to constitute a high court of justice of the Allies, whose mission it will be to try the responsible authors of the crimes of all kinds committed by the enemy during the war. Retribution for all these atrocities will come as sure as fate, and will be terrible, but that will not be enough. We shall require also that all those who committed them, who ordered them to be committed, or allowed them to be committed must suffer personal punishment. We must at once lay the foundation of such a high court of the Allies which will immediately collect evidence, and which will be ready to sit at the cessation of hostilities. The first paragraph of the peace preliminaries must enact that all persons accused by this high court must be delivered up to it for trial. This high court will thus be the first tangible and active realisation of that society of nations for which President Wilson calls.

It will be more than a little interesting to see what will happen to this motion when it is discussed in the Chamber. That it will pass we do not doubt, if only for the reason that the "Hidden Hand" does not appear to have the power in France that it has in certain other of the Allied countries, not excluding our own. France has suffered too bitterly—is suffering now—for there to be the least doubt about her determination to punish to the full extent of justice the authors of her misery, no matter how highly placed they may be. The higher the positions these arch-criminals may hold, the more condign should be their punishment by an outraged civilisation, but unless the determination to exact strict reparation is thus put into outward and visible form, we confess to a fear that, after all, the principal offenders will escape the hangman. The late Prime Minister assured the country that such reparation would be insisted upon, and that there would not be the least respect for persons in exacting it, but we should like to see the matter taken a good deal farther, and such a tribunal as that suggested brought into being at once. We quite appreciate the fact that it is as well to catch your hare before commencing the cooking process, but in this case we confess to an uneasy feeling that if we wait until the hare is actually caught there may be no cooking at all. We certainly do not want to see this particular hare decorated with a blue ribbon round his neck and kept as a pet! When M. Ignace's motion has passed the Chamber—as we feel assured it will—the same resolution might with great advantage be adopted by our own Parliament and those of the other Allied nations. Then we could get straight to work on the constitution of the tribunal and begin the collection of the names and evidence necessary to establish the *prima facie* case against the unholy horde of criminals.

## "Business Methods."

Apparently all is not well with National Service. In fact, if we are to judge from the correspondence addressed to the Press by many who have answered the appeal for workers and volunteered to serve, there is not much

that is right with it. Examples are quoted of people who have filled up the forms, sent them in—and heard nothing.

Some of the keener ones have waited a greater or less length of time and have then followed up the form with personal applications, only to be referred from pillar to post, and back again, until at last, sickened by the exhibition of official ineptitude, they have given up the quest. One of these disappointed ones, who signs himself "Anglo-Indian" tells, in the *Times* of his adventures. He sent in his form, and, hearing nothing, journeyed to London to make enquiries. There he was interviewed by a subordinate official—we know those "subordinate officials"—who had no more helpful suggestion to make than that another form should be filled up. "Anglo-Indian" went home—and filled up that other form. Then he wrote to the District Commissioner at Bristol, and after a week had elapsed was told that his name had been sent to the sub-commissioner at Plymouth, from whom he might hear "in due course."

After six weeks of waiting "Anglo-Indian" does not find himself any nearer the goal of his desires. He need not take it too much to heart, for his case is only typical of many. The whole scheme, as it stands, is really a half-baked affair, conceived in a hurry, and with no coherent organisation, so far as it is possible for the ordinary person to discern. The plain truth seems to be that the Ministry of National Service is neither better nor worse than any other Government department, in which incompetency appears to march hand in hand with waste. When we regard the administrative methods of these mushroom departments we are irresistibly reminded of a story told of a great London newspaper proprietor whose custom it is to criticise day by day the features of his paper. On one day he found occasion to comment very unfavourably on the whole of the paper, and ended his criticism with the words: "Thank God, we have plenty of money!"

Sir Frederick Milner also writes to the *Times* on the subject of the chaos that exists in many Government departments from the lack of business methods. "Hardly a day goes by," he says, "that I do not get complaints that most efficient men cannot find an opportunity of serving their country." They never will until we can get rid of the system of nepotism which governs the filling of the more responsible posts.

Therein lies the root cause of the whole trouble. It does not matter in the least what the capabilities or the attainments of the individual may be, he does not stand an earthly chance of getting the right scope for them unless he has a friend at court. He may be an able administrator, or a man of proved business worth, but unless he can get the ear of the man who has "jobs" to give away, he will probably be sent to plant potatoes while the post for which he is exactly fitted will be given to a protégé of the great man's maternal aunt, who in all probability has nothing at all in the way of qualifications for the job and may be entirely depended upon to make a howling mess of it.

We fully recognise that the work of creating all these new departments is a stupendous one, and that in doing it mistakes are inevitable, but we do submit that the percentage is all the wrong way. If we are to be governed by a bureaucracy, for Heaven's sake let it be an efficient bureaucracy and not a travesty.





### For King and Country.

The petrol call of the aeroplane; Needs must when the Defence of the Realm Act drives.

FLIGHT



## HONOURS.

### Foreign Honours for the R.N.A.S.

It was announced on the 23rd inst. that the following decorations had been conferred by the Allied Powers for distinguished services rendered during the war:—

#### By the President of the French Republic.

CROIX DE GUERRE.

Wing-Com. RICHARD B. DAVIES, V.C., D.S.O., R.N.

Squad.-Com. FRANCIS K. HASKINS, D.S.C., R.N.

Lt. DENYS C. G. SHOPPEE, D.S.C., R.N.

Lt. Viscount MAIDSTONE, R.N.V.R.

#### By the King of the Belgians.

ORDER OF LEOPOLD.

Chevalier.

Acting Flight-Com. CHARLES C. R. EDWARDS, R.N.A.S.

The King has given unrestricted permission to the officers concerned to wear the decorations in question.

### Honours for the R.F.C.

IN a supplement to the *London Gazette* issued on March 26th it was announced that the King has been pleased to confer the Military Cross on the following officers in recognition of their gallantry and devotion to duty in the field:—

Temp. 2nd Lt. JOHN WILLIAM ALDRED, R. Lanc. R. and R.F.C.

During an aerial combat with two hostile scouts, he drove one of the hostile machines down and succeeded in driving the other hostile machine back over the enemy's lines. He displayed great courage and determination throughout.



### The Use and Abuse of Steel.

At the next meeting of the Institution of Automobile Engineers, on April 11th, another paper of interest to the aviation industry will be read by Lieut.-Col. R. K. Bagnall-Wild, the head of the A.I.D., dealing with the "Use and Abuse of Steel in Aircraft Construction." As usual, the meeting-place will be the Royal Society of Arts, John Street, Adelphi, and any non-members who are interested can obtain a ticket by writing to Mr. Basil H. Joy, the Secretary of the Institution of Automobile Engineers, at 28, Victoria Street, S.W.1.

Lt. DOUGLAS HUGH MOFFATT CARBERY, R.F.A. and R.F.C.

While engaged on artillery observation, he was attacked by four hostile machines, which he succeeded in driving off, and continued to carry out his observations. Later, he was again attacked by several hostile machines and succeeded in bringing one of them down. He has previously done fine work.

Lt. (Temp. Capt.) HUBERT WILLIAM GODFREY JONES, Welsh R. and R.F.C.

With a patrol of three scouts he attacked a hostile formation of 10 enemy machines. Although wounded he continued the combat and drove down an enemy machine. Later, although again wounded, he remained with his patrol until the enemy retired.

2nd Lt. WILFRID RIPPON SNOW, R.F.C., Spec. Res.

He successfully bombed a hostile aerodrome from a height of 1,000 ft. Later, in another machine, he again bombed the hostile aerodrome from a low altitude. On another occasion he made two very daring trench reconnaissances.

In the list of awards of the Distinguished Conduct Medal for acts of gallantry and devotion to duty in the field, the following appears:—

23921 Sergt. H. G. SMITH, R.F.C.

In the awards of the Military Medal for bravery in the field, the following appears:—

320 L.-Corpl. R. A. CARTLEDGE, R.F.C.

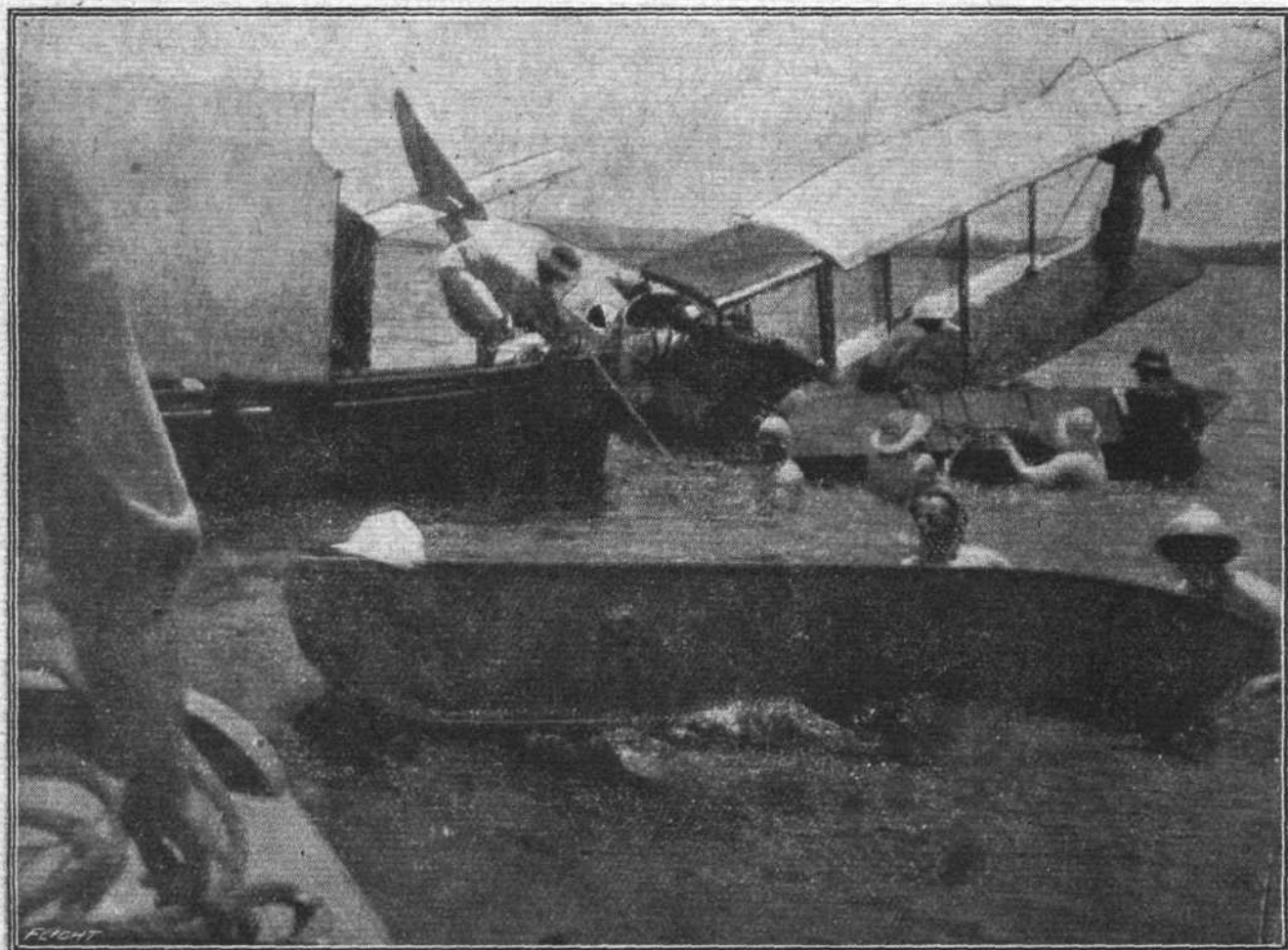


### Reward for Bringing Down "L. 39."

It is announced from Paris that the prize of 5,000 francs which was offered by a Frenchman in a letter to the *Figaro* for the soldier who brought down a Zeppelin will be divided between the men manning two anti-aircraft batteries which were responsible for destroying the Zeppelin at Compiègne.

### The R.F.C. Uniform.

The Army Council has issued an Order that all officers in the Flying Corps must, after April 15th, wear the regulation double-breasted Flying Corps tunic. At the present time many are wearing a military tunic not in accord with the regulations.



Salvaging a wrecked seaplane.



## THE LAWRENCE AEROPLANE.

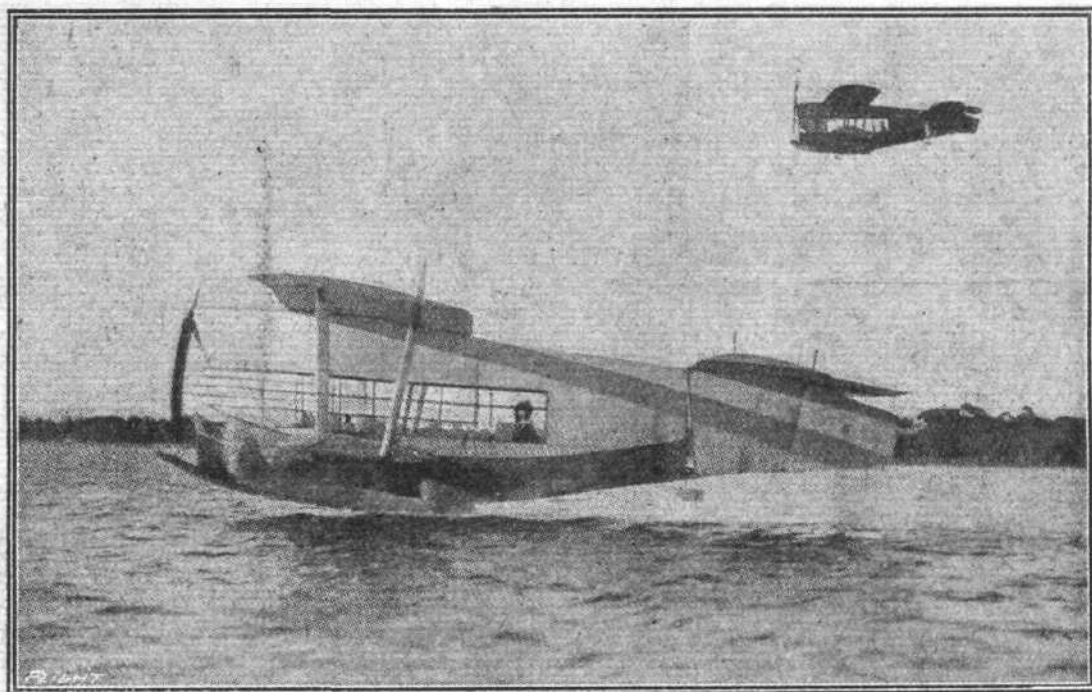
AN AMERICAN INHERENTLY STABLE AEROPLANE.

DURING 1915 and 1916 exhaustive experimental work on a new type of aeroplane was carried out by the Lawrence-Lewis Aeroplane Co. at Tampa Bay, Florida, U.S.A. The results apparently proved highly successful, as work is now proceeding with two new models—A-1 speed type, and B-1 load-carrying type—following the same principles.

From the accompanying illustrations of the experimental A-1 type, it will be seen that the machine is a totally-enclosed

an exceptionally high gliding angle, and a wide-speed range.

The simplicity of control was another marked feature. The boat is of the short-hull type, the walls being extended upwards to the top planes, and rearwards to the tail. Windows are formed in the sides from the pilot's seat, at the rear of the planes, to the nose. The main planes are, we believe, slightly arched downwards at the tips. The principal dimen-



Two views of the Lawrence inherently stable flying boat, showing it leaving the water from a standing start in under 5 secs.; and, inset, the machine in flight.

tractor biplane flying boat, although we understand that it can also be converted into a land machine. The main feature consists in the fact that neither *ailerons* nor wing-warping is required for the lateral control, this being obtained entirely by virtue of the aerodynamic properties of the machine. During the trials, consisting of over 150 flights under varied weather conditions, it was demonstrated that the machine possessed a marked degree of inherent stability, had

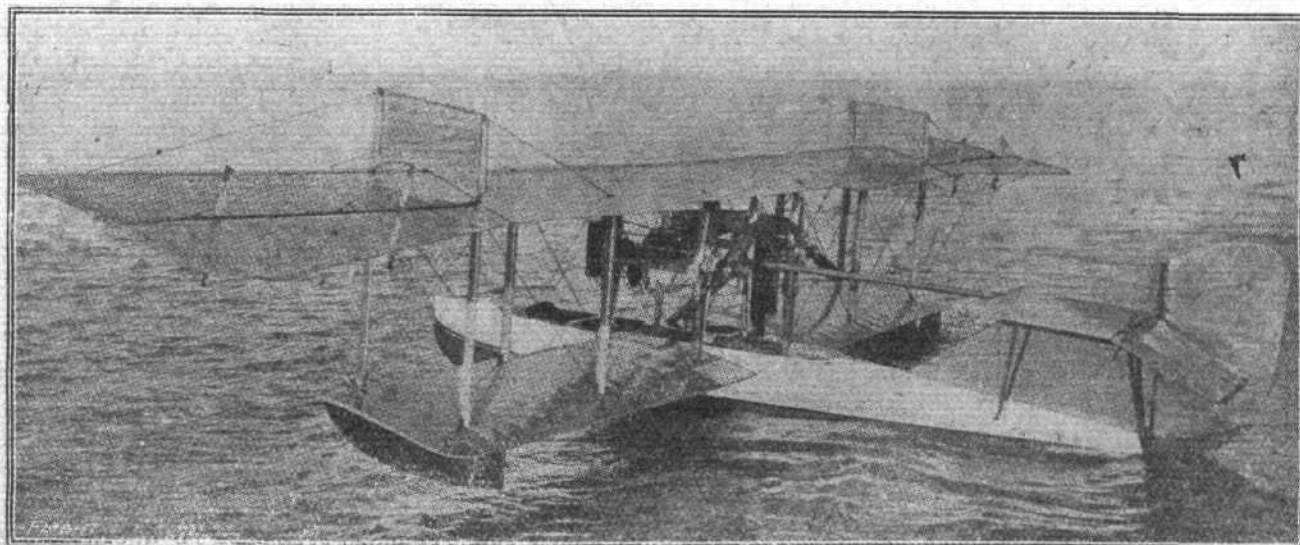
sions of models A-1 and B-1 are:—A-1: span, 30 ft.; chord, 6 ft.; gap, 4 ft. 8 ins.; overall length, 25 ft.; stagger, 6°; weight, 1,750 lbs.; useful load, 800 lbs. B-1: span, 42 ft.; chord, 7 ft. 6 ins.; gap, 5 ft. 8 ins.; overall length, 29 ft.; stagger, 6°; weight, 2,200 lbs.; useful load, 1,500 lbs.

The engine, which in each case is a 140 h.p. Hall-Scott, is mounted on the hull and drives a tractor screw, located high up in front of the bows.

### The Dilution of Labour.

THOSE who still have any doubts as to the ability of women in these urgent times to tackle practically any job in the engineering line will speedily have their doubts removed if they will pay a visit to the really remarkable exhibition of photographs and examples of women's work now being

held at the Royal Colonial Institute, Northumberland Avenue, W.C. The exhibition, which has been arranged by the Labour Supply Department of the Ministry of Munitions, will remain open until the end of this week. The aircraft section includes both metal and woodwork ranging from the making of an aeroplane rib to the turning of a Clerget cylinder from the solid billet.



The Curtiss aero-yacht *de luxe*, built for the America Trans-Oceanic Co. It is luxuriantly fitted up, and carries five passengers. We hope to give further details of this machine shortly.



# The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

## SPECIAL COMMITTEE MEETING.

A SPECIAL MEETING of the Committee was held on Thursday, the 22nd inst., when there were present: The Duke of Atholl, M.V.O., D.S.O., in the Chair, Lieut.-Col. W. D. Beatty, R.E., Brig.-Gen. W. S. Brancker, R.F.A., Flight Commander John D. Dunville, R.N., Col. Sir Capel Holden, K.C.B., F.R.S., Wing Commander A. M. Longmore, R.N., and the Assistant Secretary.

**Election of Chairman.**—On the motion of Brig.-Gen. W. S. Brancker, seconded by Lieut.-Col. W. D. Beatty, the Duke of Atholl was unanimously elected Chairman of the Club for the current year.

**Election of Vice-Chairman.**—On the motion of the Chairman, seconded by Flight Commander John D. Dunville, Col. Sir Capel Holden, K.C.B., F.R.S., was unanimously elected Vice-Chairman of the Club for the current year.

**Vacancy on the Committee.**—On the motion of the Chairman, seconded by Brig.-Gen. W. S. Brancker, Commodore Godfrey M. Paine, R.N., C.B., M.V.O., was unanimously elected to fill the vacancy on the Committee.

**Sub-Committees.**—The following Sub-Committees were appointed:—

### House Committee:

Capt. R. L. Charteris.  
C. G. Greenhill.  
Henry Knox.  
J. Stewart Mallam.  
J. H. Nicholson.  
J. H. Spottiswoode.

### Flying Services Fund Committee:

Chester Fox.  
Major T. O'B. Hubbard, R.F.C.  
Squadron Commander C. E. Maude, R.N.

### Finance Committee:

J. Stewart Mallam.  
J. H. Nicholson.  
T. O. M. Sopwith.

### Certificates Committee:

Lieut.-Col. W. D. Beatty, R.E.  
Col. Sir Capel Holden, K.C.B., F.R.S.  
Wing Commander A. M. Longmore, R.N.  
T. O. M. Sopwith.

The Chairman and Vice-Chairman are *ex-officio* Members of all Sub-Committees.

## Fatal Accidents.

A VERDICT of "Accidental Death" was returned at an inquest in Kent on March 22nd on 2nd Lieut. F. E. Hillebrandt, R.F.C., who died earlier in the day as the result of injuries caused by a flying accident.

At an inquest held at Ipswich on March 24th on Lieut. M. R. H. A. Allen, R.F.C., who died in hospital on March 21st, from injuries received in an accident to an aeroplane, a verdict of "Accidental Death" was returned. When at a height of about 150 ft. his engine suddenly failed, and, the flying speed being lost, the machine fell to the ground. Lieut. Allen was pinned beneath the wreckage.

At the inquest on March 26th on Flight-Lieut. W. S. Oliver, who was killed whilst flying in Kent, it was stated that the machine fell about 2,500 ft., and that when it emerged from a cloud it was nose-diving. The wings on one side appeared to fall away, and the aeroplane crashed to earth. A verdict of "Death by Misadventure" was returned.

An inquest was held at Angmering (Sussex) on March 26th on Flight Sub-Lieut. A. F. Harvey. The officer was making a cross-country flight preparatory to receiving his pilot's certificate, and was passing over Angmering on March 24th. Suddenly his machine was seen to turn sharply to the right when it side-slipped and nose-dived to the ground from a height of about 60 ft. A verdict of "Accidental Death" was returned.

## Flying Services Fund Committee.

A Meeting of the Flying Services Fund Committee was held on Tuesday, the 27th inst., when there were present: Major T. O'B. Hubbard, R.F.C., in the Chair, Mr. Chester Fox, Squadron Commander C. E. Maude, R.N., and the Assistant Secretary.

Eight applications for assistance from the Fund were considered, and grants and allowances were recommended respectively:—

1. To the mother of a flying officer killed in an aeroplane accident.
2. To the wife of a 2nd Class Air Mechanic of the Royal Flying Corps killed on active service.
3. To a petty officer who was injured in an airship explosion.
4. To a 1st Class Air Mechanic of the Royal Flying Corps incapacitated on active service.

## Flying Services Fund.

Boxes for collecting subscriptions for the Flying Services Fund are now available, and anyone wishing to have a box can obtain the same on application to the Secretary.

## New Club House.

Members are reminded that bedrooms and meals are available in the New Club House. The price of the House Luncheon and Dinner is 2s. 6d. and 3s. 6d. respectively.

## THE FLYING SERVICES FUND administered by THE ROYAL AERO CLUB.

THE Flying Services Fund has been instituted by the Royal Aero Club for the benefit of officers and men of the Royal Naval Air Service and the Royal Flying Corps who are incapacitated on active service, and for the widows and dependants of those who are killed.

The fund is intended for the benefit of all ranks, but especially for petty officers, non-commissioned officers and men.

Forms of application for assistance can be obtained from the Royal Aero Club, 3, Clifford Street, New Bond Street, London, W.

## Subscriptions.

	£	s.	d.
Total subscriptions received to March 20th, 1917	11,209	16	3
Proceeds of a Collection made at Church at the Royal Naval Air Station, Calshot .. ..		1	8 6
Staff and Workers of Gwynnes, Ltd. (Thirty-fifth contribution) .. ..		10	2 9
<b>Total, March 27th, 1917</b>	<b>11,221</b>	<b>7</b>	<b>6</b>

B. STEVENSON, Assistant Secretary.

3, Clifford Street, New Bond Street, W.

2nd Lieut. J. A. A. Bouie, R.F.C., died on Saturday from injuries received in an aeroplane accident in Yorkshire.

Sec. Lieut. John Leach, R.F.C., was killed while flying a military biplane at Court Moor, near Aldershot. An experienced airman, Lieutenant Leach was 600 feet high, when he was caught in a snow blizzard, which spun his machine round; he was able to right it and flew on some distance, when another blast caught the biplane, with the result that it turned a complete somersault and nosed down to earth.

Through his machine falling from a considerable height, Mr. J. B. Fitzsimmons was killed at Hendon on Monday. The machine crashed through the roof of a workshop in which a number of men were employed, but fortunately not one of them was injured.

## The Raid on Frankfort.

ACCORDING to a telegram from Frankfort-on-Main, the French pilot who flew over Frankfort on March 16th, dropped six small bombs, one of which slightly damaged the roof of a house, whilst the others fell in the Main or fields, causing no damage. The aviator was fired at by anti-aircraft guns.

## An American Pilot Missing.

THE *Journal* announces that the American airman McConnell, who has been serving with the French, has been missing since March 19th, when he took part in an air fight.



# ANSWERS TO CORRESPONDENTS.

**J. R. B.** (New Southgate).

Apparently you are labouring under some misapprehension as regards the use of the formula  $P = C\rho v^2$ . In this formula  $P$  = the pressure in whatever units of mass, length and time are employed. In this country it is usual to employ lbs. and square feet. Hence  $P$  = lift in lbs. per square foot =  $C\rho v^2$ .  $C$  is the "absolute" lift coefficient of the particular wing section employed;  $\rho$  is the density of the air. When ft. per sec. is used for the velocity the value of  $\rho$  is 0.00238; when m.p.h. is used for velocity  $\rho = 0.0051$ ;  $v$  is the velocity in one or the other of these units. In the answer to a correspondent, a cutting of which you enclosed in your letter,  $C$ , or the "absolute" lift coefficient, is the quantity sought,  $P$ ,  $\rho$  and  $v$  being given. In our article on "Units Employed in Recording the Results of Wind Tunnel Experiments,"  $P$ , the lift in lbs. per sq. foot, is the quantity sought,  $C$ ,  $\rho$  and  $v$  being given. Therefore in the first case the formula is

written  $C = \frac{P}{\rho \times v^2}$ , and in the second case it is written  $P = C\rho v^2$ . In the answer to a correspondent the loading—or, in other words,  $P$ —was assumed to be known to be 4 lbs. per sq. ft. and  $v$  to be 60 m.p.h., and it was desired to find the "absolute" lift coefficient,  $C$ . This was done by substituting in the formula  $C = \frac{P}{\rho \times v^2}$  thus:—

$$C = \frac{4}{0.0051 \times 60^2} = \frac{4}{0.0051 \times 3,600} = \frac{4}{18.36} = 0.22.$$

Therefore the "absolute" lift coefficient of that particular wing section was 0.22. How you arrive at 6 as the result we are at a loss to understand. In order to make this example analogous to that shown in the article on "Units," we will take it that  $C$  and  $v$ , or in other words the "absolute" lift coefficient and the speed, are known, and that it is desired to find  $P$ , which is the lift in lbs. per sq. ft., or, putting it another way, the loading in lbs. per sq. ft., as the lift and loading must be equal if the machine is to follow a horizontal flight path. We therefore have  $C = 0.22$ ;  $\rho = 0.0051$ , and  $v = 60$  m.p.h., and can write  $P = 0.22 \times 0.0051 \times 60^2 = 4$ .  $P$ , or the lift per sq. ft., is therefore 4 lbs. We fail to see any traces of the inconsistency you refer to.

**T. S. K. I.** (Bristol).

Dope and fabric for model aeroplanes may be obtained from Messrs. A. E. Jones, Ltd., 97, New Oxford Street, to whom we should recommend you to write for prices, &c. For an explanation of the term "lift coefficient" we would refer you to an article published in the January 25th issue of "FLIGHT," 1916, entitled "Units Employed in Recording the Results of Wind Tunnel Experiments."

**W. D. K.** (Sanderstead).

The instruments on an aeroplane usually include: Altimeter, for indicating the height; clock; compass; revolution indicator showing the speed of the engine; speedometer, indicating the air speed of the aeroplane; petrol and oil gauges, indicating the amount of fuel in the tanks. On military machines other instruments, such as wireless sets, may be fitted, but regarding these no information can be published at present.

**Aero** (Kingston).

The name "Parasol" was, we believe, first given to a Morane-Saulnier monoplane in which the wings were mounted above the pilot's head, hence the name. No simple formula exists by means of which the stability of an aeroplane can be calculated. The subject is a very complex one, and cannot be dealt with in this column. We should recommend you the book "Aeroplane Design," by F. S. Barnwell, which can be obtained from the offices of "FLIGHT." The price is 2s. 6d., post free.

**H. G.** (Langley).

Generally speaking, the centre of thrust, the centre of resistance, the centre of gravity, and the centre of lift should all coincide. It will frequently be found, however, that it is not possible to get the line of resistance to coincide with the line of thrust. In that case, if the thrust is below the resistance the centre of lift should be such a distance to the

rear of the centre of gravity that the thrust-resistance couple is equal to the lift-weight couple. Both these couples should be kept as small as possible. The chief objection, from a practical point of view, to having the engine in front and the screw at the rear, is that this arrangement entails a long shaft, which, if the power to be transmitted is of any great magnitude, means adding very considerably to the weight.

**L. J. P.** (R.N.A.S.).

Up to the present nothing definite has been agreed upon as regards what constitutes a "clockwise" and "anti-clockwise" engine. It is general practice, however, to so term an engine according to its direction of rotation as seen from the pilot's seat in a tractor. Thus, for instance, a Gnome would be termed a "clockwise" engine, since it rotates in the same direction as the hands of a clock. If the same engine is taken out of a tractor and put in a pusher, it would still be a clockwise engine, as the direction of rotation of its cylinders in regard to the crank shaft would remain the same as before. The Renault, according to above definition, is a clockwise engine, but as its propeller is mounted on the cam shaft and therefore revolves in the opposite direction to the engine, the screw fitted to a Renault in a tractor is left-hand or anti-clockwise. On the other hand, if the Renault is placed in a pusher it still remains a clockwise engine but the screw will, in that case, be right-hand or clockwise. The best known example of single spar wing construction is the pre-war type Breguet tractor biplane. This machine had a single steel tube spar, and the ribs were a loose fit on the spar, to which they were secured by steel springs so that they were, to a certain extent, free to alter their incidence according to the pressure of air on them. Unfortunately these springs used to give trouble and weaken after being in use for a certain period, with the result that after a steep dive the springs were no longer able to sustain the load, and the machines got a reputation for uncontrollable nose dives. This arrangement also had the disadvantage that, owing to the travel of the centre of pressure, the spars were subject to very great twisting stresses. Of machines with a variable incidence, that is to say machines in which the incidence could be altered during flight—which was not the case with the Breguet—the French Paul Schmitt biplane is probably the most successful, and established a number of records before the war. This machine, which was fully described in "FLIGHT" of October 30th, 1914, had a very large balanced elevator, but no fixed tail plane.

**G. M. R.** (Leeds).

So far as we are aware there is no publication, weekly or otherwise, which deals with the making of propellers. The theoretical side of the question has been fully dealt with in a number of publications, but the practical side can, we think, only be learned in a propeller factory.

**G. W.** (Burgess Hill).

Write to Major Mitchell, R.F.C., The Polytechnic, Regent Street, W.

**K. S. D.** (R.N.R.).

Apply to your Commanding Officer for permission, and then send in your application to the Director of Air Services, Admiralty, London, S.W.

**J. B.** (Cheltenham).

There appears to be no reason why you should not apply for a commission in the R.F.C. when you are 18.

**J. C.** (Dover).

Your age would almost certainly bar you from obtaining a commission in either service. If accepted you would be taught at the Government's expense.

**S. P.** (Edinburgh).

We understand that the pay is the same as that of a private.

**L. E. G.** (Enfield).

If you are passed for General Service you would not be accepted for the R.F.C. as an unskilled mechanic.

**H. G.** (Plumstead).

Your training would probably help you in an application for the R.N.A.S.



# AEROPLANE WING-TRUSSING.\*

By F. W. PAWLOWSKI.†

It is hard for an inventor or designer to break away from the forms, types, or examples already existing in nature; the first efforts to build a flying machine were therefore attempts to imitate the flapping of birds' wings, just as there were attempts to build locomotives that moved on legs.

We know how the aeroplane was finally created. It is not a replica of a bird; it does not imitate the bird-motions in flight (except to a certain extent in gliding flight), but it still retains the essentials of a bird's wing, although modified and immovable.

The problem faced by our predecessors was to build wings large enough for a man-carrying glider or aeroplane, and was an extremely difficult one. They had to answer these questions: How was the big wing surface to be made of light weight and rigid at the same time? How were the members of the wing framing to be arranged?

## Monoplane Wing-Trussing.

The examples furnished by nature in the wings of insects, birds, and bats, already adopted for the construction of the umbrella, imposed themselves so strongly upon the minds of inventors that it is no wonder we find their application in the early flying-machine, and even in Lilienthal's (1896) and Pilcher's (1899) gliders, Fig. 1, and Ader's aeroplane (1897).

The fact that Henson at the early date of 1842 adopted the Pink truss for his wing construction must be considered and recognised as extraordinary. High credit must be given his power of mind and constructive ability. The Henson wing construction contains all the essential elements of the modern aeroplane wing, such as front and rear spars, and main and secondary ribs. The reduction of the number of exposed wires as compared with the umbrella type was considerable, and it is really surprising that Lilienthal, Pilcher, and others did not adopt Henson's construction. Much later (1909) Levasseur adopted it almost without change for his Antoinette monoplane, Fig. 2. In this, as in most of the following figures, all the so-called lifting wires are shown by full lines and the so-called landing wires by dotted lines.

Several other designers of recent date adopted Henson's construction also, as it has the advantage of keeping the wings rigid even after they are detached from the body.

Although, in the meantime, the biplane wing became more prominent, we will proceed with the evolution of the monoplane wing. In 1910 Blériot adopted the Pratt truss, already popular in biplane construction, for his monoplane, which was of considerable span, Fig. 3. He evidently resigned voluntarily the possibility of almost doubling the wing area without much increase of resistance to motion.

Just a slightly different construction has survived until the present time in the German-Taube, Fig. 4. The standard type of monoplane rapidly became the most popular on account of its simplicity of construction and ease of adjustment, Figs. 5 and 6.

The use of four pairs of lifting and landing wires on each wing, as in Deperdussin's seaplane, seems to be an unnecessary introduction of too much structural resistance. Two pairs of wires, Fig. 6, are the best, and are sufficient even for large-span machines; one pair of wires is sufficient for small-span racing machines. An example is the Ponier machine, which competed so splendidly for the 1913 Gordon-Bennett Cup.

It is worth while to notice that in 1900 this type of wing trussing was used by Kress for his flying-boat, which was of a triple-tandem monoplane type, before any other machine flew. The interesting thing about it is that Kress was not an engineer but a tailor.

The resistance of the wires is a considerable item in the total structural resistance, so that Blanc in France actually built (1913) a monoplane with cantilever wings, Fig. 7, a rather risky construction considering the wing area used.

## Biplane Wing-Trussing.

The difficulty of building large wing surfaces was realised as far back as 1866 by Wenham in England. He built a sort of multiplane kite, while Stringfellow in 1868 produced a triplane model, which unfortunately did not fly. But in spite of the remarkable example of Stringfellow, such prominent mechanical engineers as Sir Hiram Maxim (1888) with his huge multiplane, and Lilienthal (1896) with one of his biplanes, could not produce a simple and statically clear

structure to combine the planes of their machines. A bridge engineer was the first to do so, and it was Octave Chanute who put the bridge truss in the biplane. Of course it could be the Pratt truss only. The idea was adopted immediately by all airplane builders. As few of them were closely familiar with the principles of frame structures, there was some abuse of the "struts and wires," so that many biplanes of the early part of the modern era of aviation resembled closely the wire entanglement for field fortifications; this is shown in Fig. 8, in which the dotted lines represent the diagonals that were ultimately omitted.

The type shown in Fig. 9 soon became standard, and prevails at the present time, the number of panels on each side varying from two to four in various constructions. Panels of equal dimensions, Fig. 9, are justifiable for bridge trusses, but are not the best for aeroplane trusses. By varying the width of panels, as shown in Fig. 10, the structure can be made of lighter weight or, for the same weight, stronger.

The forces acting in the spars increase from wing tip toward the body; it is advisable therefore to decrease the bending buckling length of the spar stations. Also, for the struts and wires the arrangement in Fig. 10 is more advantageous, as the forces acting will be more uniform; that is, the extreme struts and wires are loaded more than those in Fig. 9. The members close to the body are loaded less, thus rendering the dimensions of these members more uniform. This advantage of the *variable-panel truss* is not yet fully appreciated, although the arrangement appeared in France five or six years ago.

Then came the *overhang-type biplane*, with its well-known mechanical and aerodynamical advantages. It was introduced by Henry Farman, but had already been incorporated in the remarkable triplane model of Stringfellow. It is inconceivable, however, that Stringfellow had the same reasons for using overhang as those which influenced Farman.

The overhang is treated either with *landing-wire bracing*, Fig. 11, or *landing strut*, Fig. 12, the latter arrangement being more advantageous as it offers less resistance to motion.

The resistance of struts and wires is a considerable part of the total structural resistance, and the tendency to minimise the number of such members is therefore justified. An extreme example is one of the Bréguet airplanes, which had one panel 10.5 ft. long on each side of the body, in a machine of 40 ft. span, thus leaving about 8 ft. of free overhang on the upper wing, Fig. 13.

A more radical departure from the typical Pratt truss is displayed by the Henry Farman half-and-half monoplane and biplane machine, Fig. 14. The span of the upper wing is three times greater than that of the lower, so that the aeroplane is really a biplane (the central part) with two monoplane wings attached at the tips of the upper biplane wing. These machines are still in use in the present war.

The Ponier-Pagny biplane truss, Fig. 15, with equilateral triangles formed by struts and landing wires, is a modification of the Pratt truss, as its essential members are the long diagonals of the rhomboidal panels.

## Wireless Trusses.

The real triangular bridge truss was introduced by the Albatros Co. in Germany about four years ago. The two examples shown in Figs. 16 and 17 are commonly known as wireless trusses.

The advantage is based on the considerable difference between the resistance coefficients of struts with streamline sections and of wires or cables, the ratio or coefficient being about 1 to 10. As the thickness of struts is about ten times greater than the wire diameter, the elimination of landing wires by substituting for the lifting wires members that will transmit forces in compression as well as in tension offers interesting possibilities.

As a matter of fact, the total length of all web members of a wireless truss can easily be made much less than one-half the total length of all wires and struts of the usual truss, so that the resistance of the web members can be reduced almost one-half with a small increase of weight.

With this construction it is difficult to connect the wooden struts to the sockets so as to transmit safely considerable forces in tension; it is also difficult to rectify the structure after it warps. When the wooden spars and struts are eliminated turnbuckles and other adjusting devices are entirely unnecessary; also the difficulty of transmitting forces in tension is avoided, so it is curious why the wireless truss is not popular.

Just recently the Curtiss Co. has produced an interesting

\* Paper presented at First Aeronautic Session of the American Society of Automobile Engineers.

† Assistant Professor of Mechanical Engineering, in charge of Aeronautical Courses, University of Michigan.



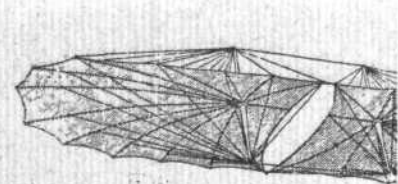


Fig. 1—Early Type of Glider

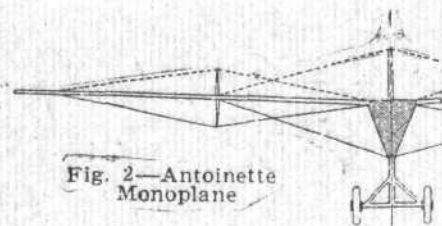


Fig. 2—Antoinette Monoplane

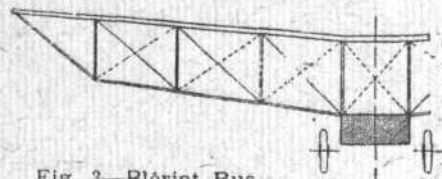


Fig. 3—Blériot Bus Monoplane

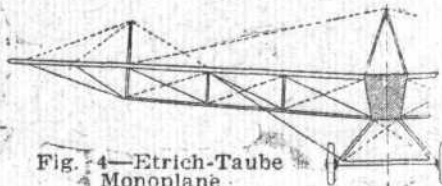


Fig. 4—Etrich-Taube Monoplane

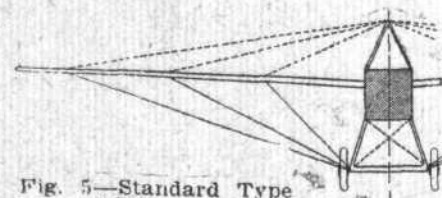


Fig. 5—Standard Type of Monoplane

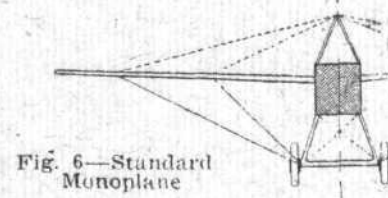


Fig. 6—Standard Monoplane

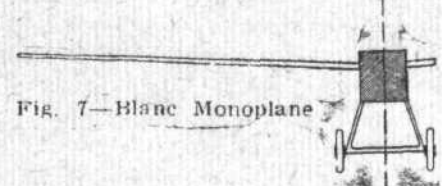


Fig. 7—Blanc Monoplane

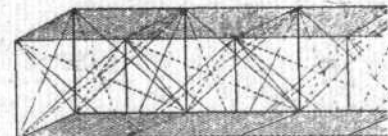


Fig. 8—Early Type of Biplane

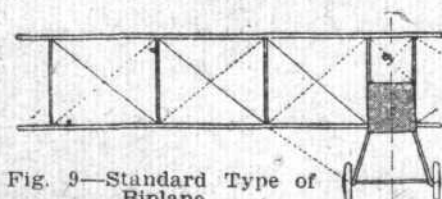


Fig. 9—Standard Type of Biplane

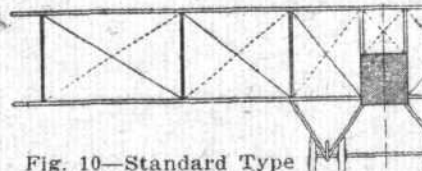


Fig. 10—Standard Type with Variable Panel-Width

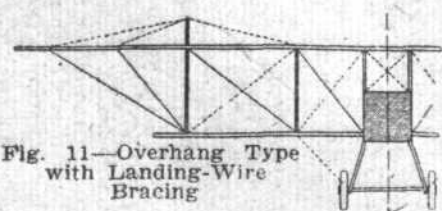


Fig. 11—Overhang Type with Landing-Wire Bracing

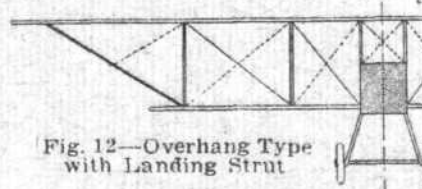


Fig. 12—Overhang Type with Landing Strut



Fig. 13—Bréguet Biplane with Single Panel

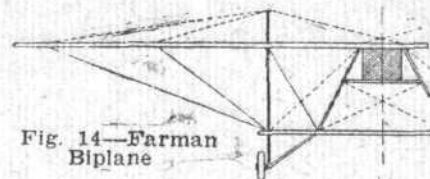


Fig. 14—Farman Biplane

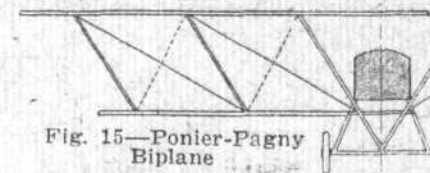


Fig. 15—Ponier-Pagny Biplane



Fig. 16—Wireless Biplane



Fig. 17—Wireless Biplane

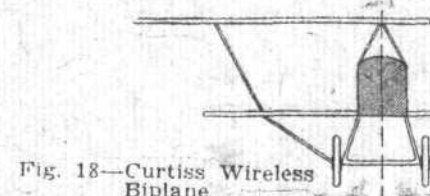


Fig. 18—Curtiss Wireless Biplane

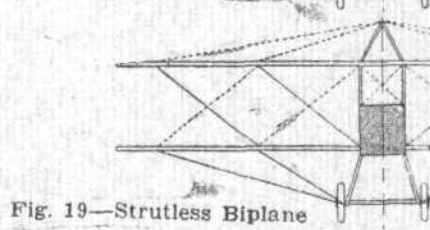


Fig. 19—Strutless Biplane

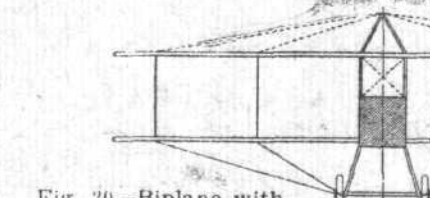


Fig. 20—Biplane with Strutless Truss

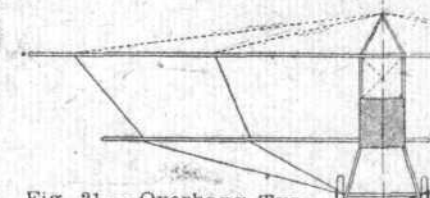


Fig. 21—Overhang Type with Strutless Truss

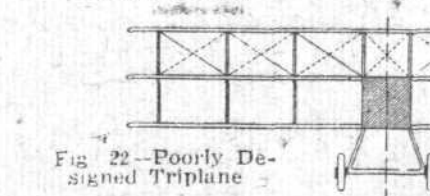


Fig. 22—Poorly Designed Triplane

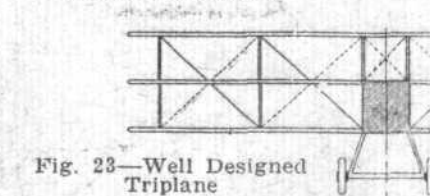


Fig. 23—Well Designed Triplane

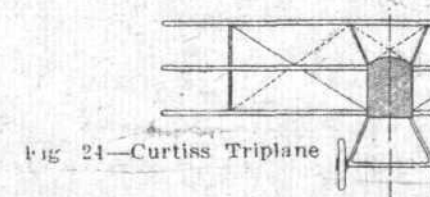


Fig. 24—Curtiss Triplane

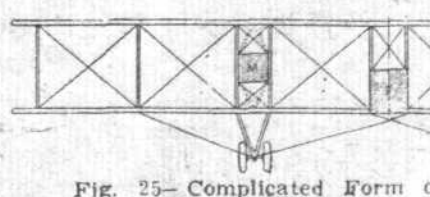


Fig. 25—Complicated Form of Biplane Truss



type of wireless truss, Fig. 18, in which the number and length of the exposed members is minimised. The construction is especially adapted to the fast small-span racing or scouting machines.

It is possible to imagine a *strutless truss* as a combination of two pairs of monoplane wings with the usual bracing, Fig. 19; but the total length of wires is considerable, so that the advantages of such a construction would be doubtful. Another form of strutless truss, Fig. 20, is much more promising, and with the appearance on the market of wires having streamline sections, it is possible that the structural resistance can be reduced even further than is the case with the wireless truss. Fig. 21 shows that this construction can be also well adapted for the overhang biplane.

## Triplane Trusses.

There were and there are few triplanes. The trusses can be treated here along the same principles as the biplane

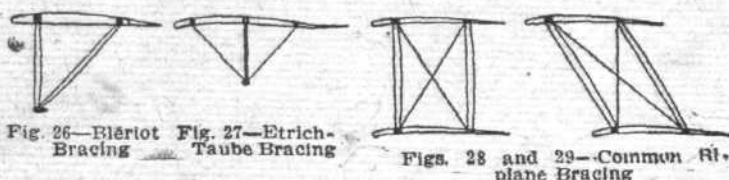
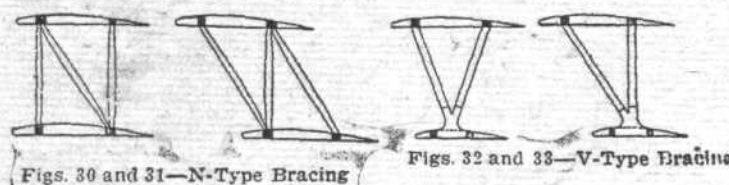


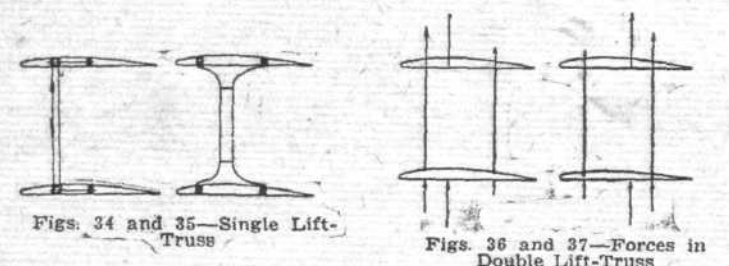
Fig. 26—Blériot Bracing Fig. 27—Etrich-Taube Bracing

Figs. 28 and 29—Common Biplane Bracing



Figs. 30 and 31—N-Type Bracing

Figs. 32 and 33—V-Type Bracing



Figs. 34 and 35—Single Lift-Truss

Figs. 36 and 37—Forces in Double Lift-Truss

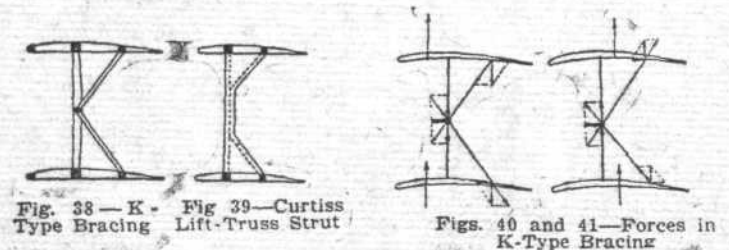
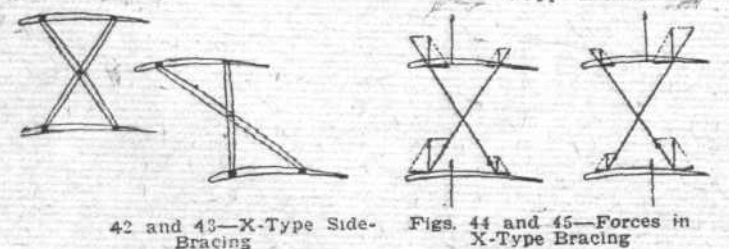


Fig. 38—K-Type Bracing Fig. 39—Curtiss Lift-Truss Strut

Figs. 40 and 41—Forces in K-Type Bracing



42 and 43—X-Type Side-Bracing

Figs. 44 and 45—Forces in X-Type Bracing

truss. I mention the triplane because in several instances the problem has been treated incorrectly, as shown in Fig. 22, in which the full height of the truss is not utilised, although it would increase the strength of the truss about four times. Figs. 23 and 24 show examples of correct treatment. The triplane has a mechanical advantage of decreasing the buckling length of struts by half, which makes them relatively several times stronger.

Fig. 25 shows a more complicated case of biplane truss for large high-power machines. The more uniform distribution of masses along the truss makes it lighter and stronger. I omit entirely the question of dynamical stability involved in spreading out the masses in this case. Here also different solutions are possible. In the Sikorski method the engines M are placed on top of the lower wing, close to the inner side of the struts. In the French method the engines are put between pairs of straight struts (see the full lines only). In the Curtiss method the engines are fixed between some special

crooked struts (see the dotted lines). Each method has some small advantages and disadvantages, which can easily be seen from the figure.

Until now we have considered only the airplane wing-truss as viewed from the front, or the so-called *lift-truss*. Inside the wings, however, are placed the so-called *drift-trusses*.\* Both the lift and the drift-trusses are combined to form a rigid three-dimension structure by means of bracing in planes passing through the struts and parallel to the plane of symmetry of the whole machine. This bracing is visible in the side view of the airplane and I will call it *side-bracing*.

## Side-Bracing Monoplane Wings.

The subject of side-bracing of monoplane wings does not offer anything of remarkable interest. Usually each wing has two parallel or slightly converging spars—the front and the rear spar. Each pair of spars, together with some central pylon or the landing chassis, taken as kingpost, form the front and the rear lift-trusses. Both are fixed in case of aileron control, and the front truss is fixed and the rear one movable in case of warping. A monoplane has usually a double lift-trussing; the spars are at the same time members of both the lift and drift-trusses.

Fig. 26 shows the side-bracing of the Blériot monoplane 'bus, on which the rear spar is braced to the lower girder of the *single lift-truss*. This arrangement is more advantageous than the one on the early type of Etrich-Taube, Fig. 27, because the separate lift and drift-truss (requiring three spars) is uneconomical from the mechanical point of view, and the two wires offer about twice as much resistance as the single-strut brace in Blériot's construction. The recent type of Taube has side-bracing similar to that shown in Fig. 26.

## Side-Bracing Biplane Wings.

The side-bracing of biplane wings offers many possibilities of design. The most common types, Figs. 28 and 29, are based on the same principle, but are adapted to the so-called, straight and staggered biplane respectively.

The terms "*lift-truss*" and "*drift-truss*" although conventional, are not quite correct. None of the trusses takes care of lift or drift alone. Really the resultant air-reaction upon the wings resolved into components parallel to the planes of the lift and drift-trusses gives the external forces acting on the trusses.

These components differ considerably from the drift and lift, not only in case of a staggered biplane, but also in a straight biplane, in which, for instance, at slow flight and large angle of incidence the forces acting on the drift-truss are frequently opposite in direction to the drift.

Figs. 30 and 31 show the N-type side-bracing, with which again the resistance of the wires of the ordinary bracing (Figs. 28 and 29) can be decreased by half. This bracing, especially when combined with the wireless lift-truss (Figs. 16 and 17), offers new and interesting possibilities for heavy large-span aeroplanes. It was applied by the Albatros Co. in the form of a triple lift-truss, which seems to be an unnecessary complication, as simpler combinations are possible.

Fig. 33 shows the V-type side-bracing, found in the modern Nieuport scouts. The two converging struts are fixed in a special socket fitted between the spars of the lower wing. This construction is also adaptable to straight biplanes (Fig. 32), but in both cases is especially good for an unequal-chord biplane. Although the trussing in the Nieuport machine is treated as of the double-lift type, there is no reason why it (preferably the rear one) could not be treated as a single lift-truss with front struts acting as braces.

## Development of Single Lift-Truss.

The first single lift-truss was used in one of the first Chanute gliders, which was a quintuplane. Chanute, however, did not seem to appreciate the advantages of the single lift-truss system, as he adopted the double lift-truss for his subsequent machines.

It was Bréguet who (1909) produced and advocated the single lift-truss biplane, his main object, however, being to vary automatically the angle of incidence of the wings, which were hinged to the steel tubular spars (Fig. 34).

A more perfect and elegant construction of the single lift-truss, which can be called I-type side-bracing, or simply I-strut, was used in Dornier's flying boat (1913). The struts, Fig. 35, were fixed in sockets having long bases that reached from the front spar to the rear spar, and were fixed to the latter. An almost identical construction was adopted in 1914 for the R.A.F. fast scouting machine. Mechanically the front and rear parts of the socket bases can be considered as a cantilever subject to bending, accordingly as the centre of

\* The drift-truss, being enclosed by the wing, does not involve aerodynamical problems, and can be treated in any desirable way from the structural point of view only. A discussion of it is therefore omitted.



pressure moves forward of or past the centre of the strut. The struts are thus subject not only to compression, but also to bending. The bending moments, however, in the average size machine are comparatively small, and can easily be taken care of by sockets as well as by the struts. In the latter case it is the maximum moment of inertia of the strut-section that comes into play, and the fibres of material affected are almost idle when buckling occurs. Geometrically and aerodynamically the sockets can be treated as a well filleted inter-section of a strut of streamline section with half of a streamline body, thus offering little resistance to motion.

#### Advantages of Single Lift-Truss.

The disadvantage of the single lift-truss system against the double lift-truss is that it cannot be adopted for staggered biplanes, especially those with a pronounced stagger. The advantages, however, are great, and can be demonstrated as follows:—

(1) The strength of the struts varies as the moment of inertia of the strut section.

At a constant ratio of diameters of the strut section, the least moment of inertia varies as the fourth power of the thickness (small diameter) of the strut.

Therefore the thickness of strut varies as the fourth root of the load that the strut can stand.

For the double load of a single lift-truss strut against the two struts of a double lift-truss, the increase of the thickness and therefore of the air resistance will be only about

$$100 (\sqrt[4]{2} - 1) = 20 \text{ per cent.}$$

or the air resistance will be reduced by about

$$100 \left( \frac{2 - \sqrt[4]{2}}{2} \right) = 40 \text{ per cent.}$$

The weights being proportional to the squares of the thickness, the gain in weight of struts of a single lift-truss against a double lift-truss will be about

$$100 \left( \frac{2 - \sqrt{2}}{2} \right) = 30 \text{ per cent.}$$

(2) The diameters of wires or cables vary as the square root of the load that the wire or cable can stand.

For the double load of one single lift-truss cable against two cables of the double lift-truss, the increase of diameter and therefore of the air-resistance will be about

$$190 (\sqrt{2} - 1) = 40 \text{ per cent.}$$

or the air resistance will be reduced by about

$$100 \left( \frac{2 - \sqrt{2}}{2} \right) = 30 \text{ per cent.}$$

There is no gain in weight, however, in this case.

(3) The larger size wires and cables of a single lift truss system allow a further gain in reduction of air resistance by using streamline wires or cables. The latter are made of streamline form by means of sharp specially attached trailing edges, which might be impracticable on the small cables of the double lift-truss system.

#### Forces Acting on each Truss.

(4) In the double lift-truss system the forces acting on each truss depend upon the position of the centre of pressure. In fast flight and a small angle of incidence, the rear truss carries a greater part of the total load—roughly speaking, between two-thirds and three-fourths of the total (see Fig. 37). At slow flight and large angle of incidence the reverse is the case, Fig. 36. Thus considering the two extreme attitudes, each of the trusses is either partly idle or has an extra strength and therefore weight.



#### The Aeronautical Society's Educational Lectures.

THE fourth of this series of lectures was delivered before a well-filled hall at Cricklewood last Thursday evening, when Capt. F. S. Barnwell, R.F.C., read his paper on "The Modern Aeroplane." Bearing in mind that the *raison d'être* of these lectures is to educate, Capt. Barnwell is to be congratulated on the manner in which he treated his subject. In the space of an hour and a half he took his audience from the first elementary principles of the aeroplane right into the technical complexities of aeroplane design so lucidly, that both tyro and expert were instructed and interested. He also touched upon the various types of machines in use and their performances, and then indulged in a cursory glance into the future, giving examples of two "useless" machines having remarkable performances.

#### Two Aeroplanes from Batavia.

THROUGH Mr. Beckett, the British Consul-General in Batavia, the British residents in the Dutch East Indies have forwarded to the Overseas Club £3,815 for the purchase of two aeroplanes to form part of the Imperial Aircraft Flotilla.

In the single lift-truss the forces acting on the truss are almost independent of the centre of pressure, as the reaction of the load at the root of the cantilever is equal to the load and independent of the bending arm.

Thus, the forces acting on a single lift-truss will be about 25 to 35 per cent. smaller than the forces of which the front and rear trusses of the double system must take care in the worst cases. This will result in another considerable reduction of weight and air resistance.

#### Special Types of Side-Bracing.

Fig. 38 shows a K-type side-bracing proposed by Capt. Martin (*Scientific American*, 1911). It is another interesting type of the single lift-truss that has all the advantages mentioned. Besides, as can easily be seen from the action of forces in Figs. 40 and 41, the extra bending moments in the I-type strut due to the cantilevers (sockets) are eliminated entirely. This advantage, however, is strongly jeopardised by the extra weight and resistance of the braces.

The Curtiss single lift-truss strut (Fig. 39), which is used in the wireless-truss biplane and in the new triplane (as far as it can be understood from the published details), is built up of two steel tubes, one straight, the other bent in two places; both tubes being inclosed by a covering. The character of cover determines whether this strut should be considered either as of the Martin's K-type, without the advantage of eliminating bending, or as a simple and cheaper type of the Dornier cantilever or I-strut type.

Finally the X-type side-bracing (Figs. 42 and 43) offers also certain advantages, especially as compared with the standard type (Figs. 28 and 29) and even with the N-type (Figs. 30 and 31), as it belongs to the double lift-truss class.

The advantage over the N-type is that there is one strut less. The advantage over any other double lift-truss system is that the amount of load carried by each truss is practically independent of the variation of the centre of pressure, although there is a certain increase of the forces due to the angularity of the struts. (See action of forces in the two extreme cases in Figs. 44 and 45). The trusses therefore do not have as much extra strength as in all the cases of two parallel lift-trusses.

The gain in resistance and weight is evidently somewhat smaller than in the case of I-strut, but in return the X-type side-bracing is adaptable to staggered biplanes and to large big-chord wings. The I-strut, and in general the single-truss, would offer too many constructive difficulties in these cases.

Numerous interesting and entirely new possibilities in biplane construction can be obtained by combining the types of trusses and side-braces previously described. Examples are:—

1. Wireless truss (Figs. 16, 17 or 18) combined with N-type bracing (Figs. 30 or 31) can be treated as (a) double lift-truss system or (b) single lift-truss system. In case (b) remarkable results can be obtained by placing the front and rear bars of the N in vertical planes parallel to the plane of symmetry of the airplane.

2. Wireless truss combined with V-type bracing can also be treated as (a) on a double lift-truss system or (b) on a single lift-truss system.

3. Wireless truss combined with the I-struts—an almost ideal structure for small fast machines.

4. Wireless truss combined with the X-type bracing, giving a construction with the least number of members for big-span and big-chord machines.

5. Strutless truss (Fig. 20 or 21) combined with the X-type bracing, and so on . . . as I do not attempt to exhaust, but merely to indicate the possibilities.



#### Prominent German Airman Missing.

IT was officially announced from Berlin on March 22nd, that "the aeroplane piloted by Prince Frederick Karl of Prussia, which went for a flight over the enemy lines between Arras and Peronne, has not returned." Berlin, also on March 22nd, announced that the crack military pilot Fritz Mannschott had been killed in an aerial fight on the Western front. According to the German story, Prince Frederick, on March 21st, took part with an air squadron in a flight towards the enemy. North of Bapaume the squadron sighted some enemy aeroplanes belonging to a squadron of one-seaters. In the ensuing battle, concentrated fighting by the squadron was impossible owing to the numerous clouds. The Prince, who was flying in the rear, became engaged in an air battle unnoticed by the others, and his aeroplane was only seen when descending in steep spirals. It was then 600 ft. from the ground, and any assistance was impossible. The aeroplane landed close to some enemy troops near Lagnicourt-Vaux, and the Prince, apparently wounded, was removed from his aeroplane and carried away by some soldiers who had hurried to the scene.



# AIRISMS FROM THE FOUR WINDS

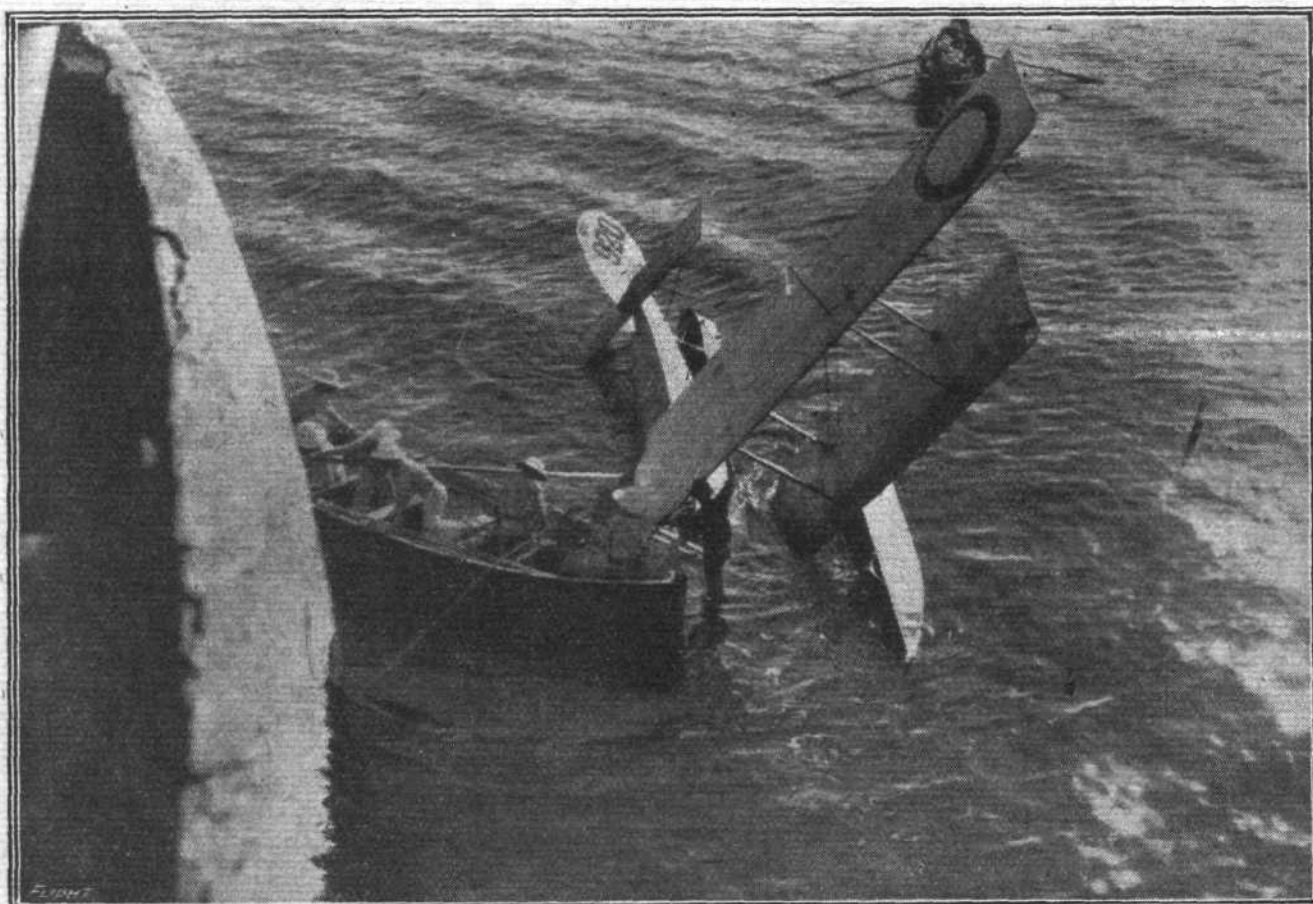
ZEPPELIN time is well on the way to commence for 1917. Activity in the near future may be safely looked for, and this time Scouting for the German High Fleet will be even more in evidence than in past years. Matters aquatic as well as aviatric are distinctly on the screen just now. Already the Zepps. are out hunting in pairs, and in wide fields of operation.

On the Somme front again the German Air Service is undoubtedly making itself felt very acutely indeed. The most strenuous efforts, and in a very unpleasantly successful way, are being put forward on the German side to prevent our "Eyes" spotting too accurately the dispositions which Hindenburg has been planning. And judging by the unusually large number of our pilots who are going down, the penalty for our insistence appears to be pretty drastic. An analysed table of the machines in use with their "history" should be very illuminating, and should give highly valuable data for those in charge at home, upon which to found a thorough overhaul of super, good, bad and worse machines. It is a hopeless proposition not to look facts as they are squarely in the face. Scrapping of obsolete fighting machines, both made and in the making, should be ruthless and immediate, if the situation is to be saved. The Huns are having air matters, at present, far too much their own way, to make the future a pleasant outlook, if the much required antidote to their enterprise is not pretty speedily in evidence in larger numbers than at present. Our men will, and do, take all and every chance against them, but the sooner the bottom-dog handicap is on the enemy's side the better.

The latest Departmental "annexation" is the Home of the Institution of Electrical Engineers, which has fallen to the embrace of the Air Board, which has pushed out its grappling iron from the adjacent Hotel Cecil.

THE National War Museum looks like catching on with no mean hold. A highly practical and valuable Committee has been got together by Sir Alfred Mond, who, in his capacity of First Commissioner of Works, will act as Chairman. The remainder of the Committee are: Sir Martin Conway, Director-General; Commander C. C. Walcott, R.N., Representative of the Admiralty; Mr. B. B. Cubitt (Assistant Secretary to the War Office), Representative of the War Office; Colonel J. R. Stansfeld (Chief Technical Officer in the Department of Munitions Inspection), Representative of Ministry of Munitions; Mr. Ian Malcolm, M.P.; Professor C. W. Oman (Chichele Professor of Modern History, Oxford); whilst Mr. Charles J. Foulkes (Curator of the Armouries of the Tower of London), will act as Curator and Secretary, with offices for the present at H.M. Office of Works, Storey's Gate, S.W.

ALL, including public bodies who have objects of National interest connected with the war, are asked to co-operate in making this museum a "joy for ever," although for the moment it is not desired that actual exhibits should be forwarded. A preliminary letter offering and specifying the object should be sent to the Secretary, when its acceptance would follow in due course. The main object of the War Museum is to collect and preserve for public inspection objects illustrating the British share in the war. The exhibits will comprise examples of the arms and other war materials used by the British naval and military forces, trophies captured from the enemy, souvenirs found on battlefields, inventions connected with munition making at home, the literature and art of the war (including regimental magazines and trench drawings), maps, the music of the war, placards issued by the Government in connection with the recruiting, economy, and loan campaigns, medals and decorations, flag-day souvenirs, and autograph letters of some of those who have taken distinguished parts in the war.



Another view of salving a seaplane after an accident.





**Capt. Gilbert W. Murlis Green, M.C., D.S.O., &c.,  
17th Squadron R.F.C., Salonica Force.**

THE committee of the Royal Flying Corps Hospital have received from Lady Tredegar (to whose generosity they owe the use of her house, No. 37, Bryanston Square) a cheque for £375 in respect of the maintenance for a period of six months of "the Lady Tredegar Ward" and one additional bed in the hospital.

FLYPAPERS, it is notified, are among the prohibited exports from Sweden. We understand, however, that the paper of the Svenska Aeronautiska Sällskapet will still be allowed to go through.

Our staff Pessimist suggests this may be another wily and subtle Hun plot to encourage the fly scourge and spread contagion in much-hated Albion, and so further help the work of the Über and Unter-Marine campaign against these Islands.

FROM German sources the information has leaked out that Zeppelins have visited Petrograd and London, and by means of special magnets (or is it magnets?) snapped up the Tsar and King George. It is Canon Parfit who has let the cat out of the bag. The canon has spent some 20 years or so in Baghdad and Syria, and this was one of the tales, it appears, which German officialdom thought good enough to bait the Arab Chiefs in Mesopotamia with, for the purpose of seducing them from their loyalty to England. Like in a good many other of their conclusions, the Huns ran amok also in this direction, as the Moslem leaders declined to have anything to do with the Satanic Kaiser or the Sultan, and the result is now seen in the magnificent progress of General Maude. Should Canon Parfit repeat his lecture on the "Amazing Story of Kut," during which at the Queen's Hall he introduced the snapping-up fable, we can promise any of our readers who are able to attend an evening full of rich amusement and interest.

THAT is a fine record put forward from Salonica by Mr. G. Ward Price the other day, of Capt. Gilbert W. Murlis Green, R.F.C. In describing Capt. Green's exploit, Mr. Price says:—

"Three German aeroplanes have been brought down in two days on the Doiran front by Capt. Green, R.F.C., who had

already accounted for four enemy machines single-handed, and another one in which he shared the honours with a brother airman. To appreciate the skill which this record represents it must be remembered that the German air activity on this front is less than in France, and that, moreover, they invariably do their best to avoid combat, so that considerable determination and willingness to take risks are needed to bring about an engagement.

"Yesterday Capt. Green flew into the midst of a squadron of six bombing aeroplanes and brought two of them down. One fell between the lines and the other in flames behind the enemy's trenches. To-day he engaged an Albatros, with the result that it dived out of control, and its pilot was seen to fall from it."

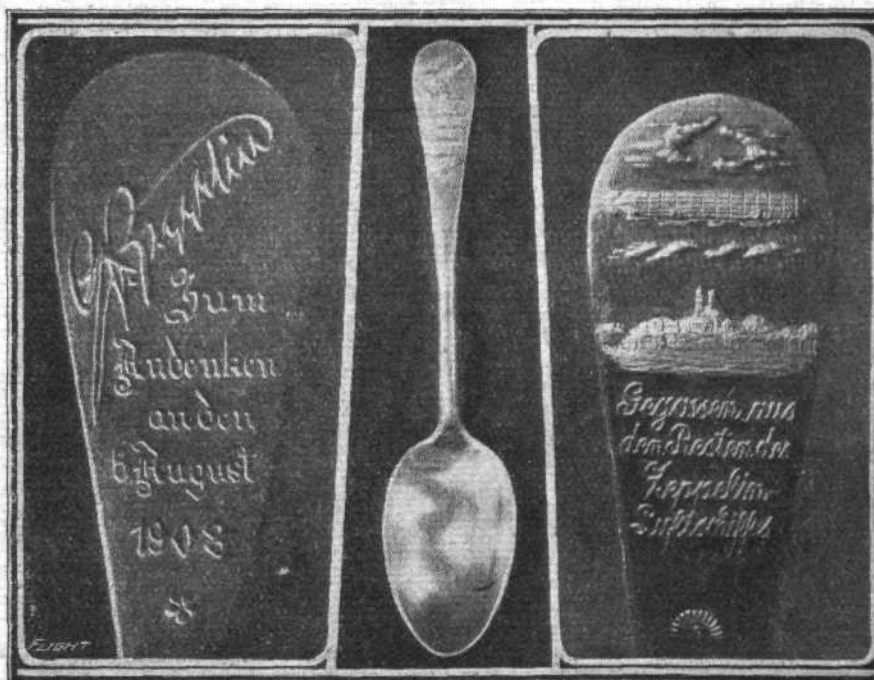
FOR these and many other duties effectively accomplished in the air Capt. Green, Mr. Ward Price continues, has received the D.S.O. and the Serbian Order of the White Eagle, which is given only for military deeds of exceptional brilliance. These are in addition to the French War Cross and to the Military Cross with a bar which he already held. His work and that of all the British airmen here is carried on in particularly difficult conditions. Landing places are rare among the Balkan mountains, and flying conditions are often of the roughest.

#### TEN YEARS AGO.

Excerpts from the "Auto." ("FLIGHT's" precursor and sister Journal) of March, 1907. "FLIGHT" was founded in 1908.

#### THE BLÉRIOT AEROPLANE.

M. Louis Blériot, so well known in automobile circles, and who has been interested in aeronautics for the design of aeroplanes for a considerable time past, has perfected a new type of machine with which he hopes to be able to take the air very shortly. The machine has some peculiar features, and consists of a single aerocurve with a forwardly protruding girder, at the end of which is mounted a tail for controlling the height of the machine. The motor is mounted near the middle of the aerocurve. The chief peculiarity of the machine, however, is that the aerocurve is of sinuous cross-section looked at fore and aft, and has the edges of the aerocurves turned up. The use of struts and wire ties has been reduced to a minimum, and the material of which the aerocurve is composed is a sort of *papier-mâché*, which



AN INTERESTING ZEPPELIN MEMENTO.—A valued reader of "FLIGHT" has sent us along an aluminium spoon, of which the above is a photograph (with enlargements of the inscription on either side), which has been cast from the remains of "Zeppelin IV," which was completely wrecked and destroyed at Echterdingen on August 5th, 1908, as recorded in detail at the time in "FLIGHT." The inscription on the spoon bears Count Zeppelin's signature, a reference to the airship and to the fact that it is cast from the remains of the Zeppelin airship.



assumes a smooth surface, the object being to diminish as far as possible resistance to passage through the air.

## A BAD WEEK.

Last week was rather a bad one for the aeroplanes. No less than three of them were out near Paris—the Blériot, Delagrangé and Santos Dumont flying machines—but none of them distinguished themselves at all favourably. At Bagatelle something went wrong with the propelling mechanism of M. Blériot's machine, which brought his experiments on the Thursday to a conclusion almost before they commenced. On the same day the Delagrangé fared no better, and was injured in being brought out, before it attempted to fly at all. On several days during the week experiments were made by M. Santos Dumont at St. Cyr. He made numerous charges across the ground at high speed, some of them extending for a length of 500 to 600 yards. He is very well satisfied with the stability and general promise of the machine, but did not get off the ground. Whether he made any attempt to do so is at present some-

what uncertain, as he is understood to be intending to familiarise himself thoroughly with the working and manipulation of the machine before attempting actual flight.

Practically the same observations may be made with regard to the aeroplane of M. Vuia, who, on Sunday, made four trials with his machine, but, like the others, also failed to get up in the air.

## BALLOON-POTTING—A NEW SPORT.

Germany is getting ready for the aerial warfare of the future. As she is not quite so far ahead as France in the matter of airships, she is practising the rank and file of her army in "potting" at them. Special balloons and airships are to be provided as targets for gun and rifle fire, so as to throw light on the important question of the damage that may be done. It is intended also that the balloons and airships (if any) should not be deprived of the right of retaliation, and they are also to experiment in seeing what damage they can do by dropping explosives, and by other operations of a similar kind.



## Casualties.

Second Lieutenant H. G. C. BOWDEN, R.F.C. (killed in action on March 11th), was 20 years of age, and the son of Mr. and Mrs. G. H. Bowden, Sunningdale, Reigate. He was educated at Cranleigh School. He represented his school at Bisley for the Ashburton Challenge Shield in 1913 and 1914, and in the latter year won the Surrey Rifle Association's silver medal offered for the best shot among Surrey cadets. His squadron commander writes to Mr. Bowden: "I am sure it will be some consolation to you to know that your son died a very gallant airman's death. The pilot who was flying the other machine which accompanied him was Captain the Hon. E. P. F. Lubbock, who, together with his observer, was killed. Captain Lubbock was brought down first, and your son put up a very brave fight against superior odds until he was also brought down."

Major EVELYN PAGET GRAVES, Royal Field Artillery, attached R.F.C., previously reported missing, now stated to have fallen in action, was the eldest son of Major the Hon. Adolphus Graves, of Queen Anne's Mansions (uncle of the present Lord Graves), and was 26 years of age. He passed out of Woolwich into the Royal Artillery in December, 1910, and was promoted in December, 1913. Major Graves entered the Royal Flying Corps in October, 1914, and in June of last year was appointed Squadron Commander.

Second Lieutenant GEORGE CHANDOS HOSKINS, General List and R.F.C., killed, was the only son of George T. and Mrs. Hoskins, of Windermere, Wellfield Avenue, Muswell Hill, and formerly of Winchmore Hill, N. He was educated at the Merchant Taylors' School, and was a keen athlete. He served his apprenticeship to the Merchant Taylors' Company and obtained the Freedom of the City of London. He offered his services before war was finally declared, and joined the H.A.C. on August 4th, 1914. He went to Egypt, where he obtained his commission, and was afterwards attached to the Manchester Regiment. In June, 1916, he was transferred to the R.F.C., and was ordered to England to train as a pilot. He soon obtained his wings, and was sent to the Front, where he was killed on March 11th, aged 24.

Lieutenant EDMUND LLEWELYN LEWIS, Essex Regiment and R.F.C., who was killed by the fall of his machine over the German lines on December 26th, after a single-handed fight with five enemy machines, in which he brought down one of them, was the eldest son of Mr. Hugh Lewis, of St. David's, Templewood Avenue, Hampstead, London manager of the Liverpool and London and Globe Insurance Co., Ltd., and was 21 years of age. Educated at Marlborough and in Germany and France, he had returned home to take up a career at Lloyd's, when, on the declaration of war, he was appointed to a commission in the Essex Regiment. In July, 1915, he left for the Dardanelles, but was invalided home in the following November. During his convalescence

he learned to fly, and was seconded to the Royal Flying Corps in March, 1916. Within three months he was at the Front, and after being engaged in many combats, was wounded while fighting single-handed six enemy machines. On this occasion, with controls shot away, he managed to land safely on our side of the lines. After two months' sick leave he was again at the Front. He was gazetted Lieutenant on the day after his death.

Second Lieutenant ERIC CLOWES PASHLEY, R.F.C., killed while flying in France on March 17th, was the son of Mr. A. W. H. Pashley, of 27, Badminton Road, Nightingale Lane, S.W. He obtained his pilot's certificate (No. 139) at Brooklands on a Sommer biplane in September, 1911, two months after his brother Cecil had qualified. With his brother Cecil Pashley he started a school at the Shoreham Aerodrome in 1913, where an accident resulting in a broken leg necessitated a long spell of enforced rest from flying. On the outbreak of war he was engaged in testing new aeroplanes, and later joined the R.F.C. and went to France, where he accounted for ten enemy machines.

Captain GEORGE WENDEN, Border Regiment and R.F.C. (killed in action on March 16th), was eldest son of the late James Gordon Wenden, the Chantry, Dursley. He was 23 years of age, and had his commission in the Border Regiment in November, 1914. He received the rank of Captain in February, 1916, when he was appointed Flight Commander, Royal Flying Corps.

## Married and to be Married.

On March 21st, at Jesmond Parish Church, Lieutenant-Colonel EDWARD NEWMAN FULLER, R.F.C., youngest son of GEORGE FULLER, of Chichester, was married to DOROTHY KATE, eldest daughter of Mr. and Mrs. JAMES LEGG, of Paul's Dean, Salisbury.

## Items.

Capt. GILBERT W. MURLIS GREEN, M.C., D.S.O., &c., whose air exploits at Salonica are referred to elsewhere, is just 22 years of age. The son of Mr. W. Murlis Green, of Beckenham, Kent, he was educated at Laleham College, Margate (where he learned to box), and at Godesberg-on-Rhine, where he won the championship of public schools of Germany as a boxer in 1911-12. He joined the Queen's Westminsters as a private August 6th, 1914, was given a commission and transferred to 7th (S.) Suffolks in September, 1914, transferred to Army Cyclist Corps January, 1915, and went to France May, 1915. Transferred to Royal Flying Corps as observer there August, 1915; came home April, 1916; secured his second wing May, 1916, and was instructor at Doncaster till August, 1916, when he was sent to Salonica. There he earned the Military Cross January 1st, 1917, and the bar for same was given six weeks later. One of the aeroplanes he brought down in December last contained as pilot Count Schwerin, of Mecklenburg, a cousin of the Kaiser.



# AVIATION IN PARLIAMENT.

## The Types of Bomb-Dropping Machines.

MR. PEMBERTON BILLING, in the House of Commons, on March 20th, asked the Under-Secretary of State for War whether he is prepared to consider the standardisation of some type of bomb-dropping machine that they may be produced in a sufficient quantity to undertake a sustained offensive behind the enemy's lines?

The Parliamentary Secretary to the Air Board (Major Baird): The possibility of such a standardisation as the hon. Member suggests is being kept in mind. But the production of various types of aeroplanes must be governed by the requirements of the naval and military Services.

MR. BILLING asked the Under-Secretary of State for War whether the machines known as BE 2 C, BE 2 E, and BE 2 D are now being used for offensive work or for bomb-dropping behind the German lines; and, if so, what is the average speed and climb of these machines?

Major Baird: The answer to the first part of the question is in the negative; the second part, therefore, does not arise.

MR. BILLING: Am I to understand that these machines are not being employed over the lines?

Major Baird: That was not the question the hon. Member put down.

MR. PRINGLE: "For offensive work," yes.

MR. BILLING: Are these machines going over the lines for offensive work? It is a perfectly straightforward question.

Major Baird: It would not be in the public interest to state what kind of machines are used.

MR. BILLING: Does the hon. and gallant Gentleman appreciate that it would be in the interests of the pilots?

Major Baird: I certainly appreciate that, but the hon. Member must recollect that any answer given here is at once sent over to Germany, and it does not suit us, in the interests of the pilots or of anybody else, that the Germans should have this information.

## Control of the Royal Aircraft Factory.

MR. BILLING asked the Under-Secretary of State for War whether Lieut.-Col. O'Gorman is still in control of the Royal Aircraft Factory; and, if not, for what reasons was he removed from his post?

Major Baird: Lieut.-Col. O'Gorman ceased to be superintendent of the Royal Aircraft Factory upon his appointment as consulting engineer to the Director-General of Military Aeronautics.

MR. BILLING: May I ask whether the hon. and gallant Gentleman is aware that it is the custom of the Director-General of Military Aeronautics constantly to send Lieut.-Col. O'Gorman to the factory and use his influence?

Major Baird: That is altogether contrary to the facts. The Director-General of Military Aeronautics makes the best possible use of Col. O'Gorman.

## An Observer's Death.

MR. BILLING asked the Under-Secretary of State for War whether his attention has been drawn to the particulars in connection with the death of C. J. Jarvis, an aeronautical observer in the Royal Flying Corps; and will he say what type of machine he was in at the time, and to what cause is his death attributable?

MR. MACPHERSON: This officer was in a BE 2 D at the time of his death. I have no details of the casualty, which took place as long ago as October 26th, 1916.

## Orders for Sopwith Triplane Scouts.

MR. BILLING asked the Under-Secretary of State for War whether the order for the Sopwith triplane scout has been altered or cancelled; and, if it has been cancelled, will he say when this machine was offered to the authorities; when the order was placed; what number were ordered, and what deliveries have taken place, and if this order has been cancelled for what reason?

Major Baird: Parts 2, 3, and 5 of this question are repetition of a question addressed to me by the hon. Member on the 12th inst. I regret that I can add nothing to the reply which I then gave him. It would be contrary to the public interest to furnish the remainder of the information asked for.

MR. BILLING: May I ask whether it is not in the public interest or in the interests of this House that contracts of this description, which are unfortunate, should be discussed or debated?

Major Baird: No. The interests of the House and of the public, I take it, are the same as the interests of the nation, and at this particular moment it is very undesirable that we should give to Germany information which would enable them to know how long it takes us to produce new machines.

MR. BILLING: Is the hon. Member not aware that this machine was offered by this firm twelve months ago this month, and that it took eight months for the authorities to make up their minds what they were going to do about it?

Major Baird: On a point of Order, Mr. Speaker. I have just invited the attention of the hon. Gentleman to the point that it is not desirable to give information to Germany as to the time which it takes us to get machines out, and he has just stated precisely the thing that I have said, it is not in the public interest to state.

MR. BILLING: I should like to point out, Mr. Speaker, that the information I asked for was not how long it took for us to turn it out, but how long it took our authorities to make up their minds?

MR. SPEAKER: That is one disadvantage of asking questions without putting them down on the Paper.

## The Construction of Service Machines.

MR. BILLING asked the Prime Minister whether he will take steps to provide for the appointment of one technical head for both the naval and the military branches of aeroplane construction; and whether he will see that powers are given him to control the design and requirements of machines for both of these Services?

The Chancellor of the Exchequer (Mr. Bonar Law): I see no reason for disturbing the present arrangement, which was only recently arrived at after the fullest consideration, whereby the control of the design of aeroplanes and seaplanes to be ordered for both Services is vested in the Air Board, on which both Services and the Ministry of Munitions are represented.

MR. BILLING: Is the right hon. Gentleman aware that this administration has been responsible for some 500 or 600 machines—at present brand new machines—being deposited in all the available places around? Is he aware that I spent the morning going round to these depots and inspecting them?

MR. BONAR LAW: I am certainly not aware of the last part of the question and I have no reason to believe the accuracy of the first.

## Another Inquiry Suggested.

MR. BILLING asked the Prime Minister, whether, in view of the present state of our Air Services, he is prepared to consider the appointment of a Committee of Members of this House privately to inquire into and report upon the general administration of our Air Services?

MR. BONAR LAW: I am not prepared to accept the suggestion contained in the question.

MR. BILLING: Is the right hon. Gentleman prepared to take some steps to inquire into the present administration and the present condition of affairs in the Department?

MR. BONAR LAW: The subject has been most minutely investigated by the

Cabinet, and we are satisfied that everything is being done that can be done at the moment.

MR. WATT: Was it not on the question of the Air Service that the last Government went out, and has this Government been any improvement?

MR. BONAR LAW: I think the hon. Gentleman is confusing this Government with that of France.

## Anti-Aircraft Corps.

MR. GLANVILLE asked the First Lord of the Admiralty whether the Admiralty entered into a contract with the men in the Anti-Aircraft Corps which was not terminable by either party except for ill-health or misconduct, or do the Admiralty claim the right of cancelling the contract whilst refusing it to the men?

DR. MACNAMARA: The Admiralty have full authority to discharge these men.

## Royal Naval Air Service.

MR. BILLING asked the First Lord of the Admiralty what has been the cost to the nation for the creation, expansion, and establishment of the Royal Naval Air Service since August 4th, 1914?

DR. MACNAMARA: Even if the clerical work involved in computing the cost were commensurate with the advantages to be gained from it, the Admiralty cannot undertake in the middle of war to give information of this kind about a fighting service.

## Machinery for Aeroplane Building.

MR. BILLING asked the Minister of Munitions whether it is the custom of the Minister of Munitions to refuse to grant permits for the purchase of necessary machinery for the manufacture of aeroplane parts; whether new machinery capable of this accurate work is standing idle in the warehouses on this account; whether the Ministry have prepared a list of second-hand machines throughout the country, many of which are incapable of producing accurate work; and whether manufacturers are pressed to purchase these second-hand machines by the Ministry; if so, for what reason?

SIR W. EVANS: In order to avoid waste of labour and material in the manufacture of machinery beyond what is absolutely essential for the production of war material, a special section of the Ministry is charged with the duty of scrutinising all demands for new machinery, and of sanctioning or refusing the supply of such machinery in accordance with the circumstances of each case. While this scrutiny is being made, it is possible that suitable new machinery may remain unoccupied, but my right hon. friend will be pleased to investigate any special case of undue delay the hon. member cares to bring to his notice. For the reasons stated, the Ministry endeavours to arrange for the utilisation of existing second-hand machinery where it is available and technically suitable.

## Tools Allowance in the R.N.A.S.

GENERAL IVOR PHILLIPS, on March 21st, asked the Secretary to the Admiralty whether A.M.C. ratings in the Royal Naval Air Service are required to find their own tools at an initial cost of £13 10s.; whether he is aware that the Admiralty allowance of 3d. per day for the use of these tools in the service of the State is insufficient to cover the cost of the wear and tear of such tools and provides no funds to pay for the use of the tools in the service of the State or to pay for loss and breakage; and whether he will consider the desirability of providing Government tools or increasing the daily allowance so as to prevent loss falling on the men?

DR. MACNAMARA: The circumstances in which these ratings have been required to find their own tools were explained in my answer to my hon. friend the member for the Westhoughton Division on February 21st. These ratings are generally enlisted from artisans who would already possess most of the tools contained in the list recently drawn up by the Admiralty; therefore an expenditure of only a few shillings would be necessary in most cases to bring the man's kit up to Admiralty requirements. Facilities are afforded to purchase tools at Government rates, which are considerably below those at present ruling in the retail market. Used Government tools may also be purchased to complete the kit at four-fifths of the Government rate for new tools. The 3d. per day allowed for upkeep of tools amounts, roughly, to £4 10s. per annum, sufficient to provide a new kit of tools every three years. The allowance should, therefore, amply cover depreciation and breakages. Practically all the tools included in the standard equipment are necessary to a fully qualified carpenter in civil employment—certainly none could be considered as useless on the man's return to civil life. It is, however, intended to issue a revised list of tools which will bring the cost of the full kit considerably below £13 10s.

## Sir Douglas Haig and the Air Services.

MR. BILLING asked the Parliamentary Secretary to the Air Board whether General Sir Douglas Haig has expressed his dissatisfaction, either directly or indirectly, with certain types of machines which are being employed in France; whether the BE 2 E, BE 2 C, or BE 2 D machine is still being ordered; and, if so, in what quantities?

Major Baird: The answer to the first part of the question is in the negative; but I would refer the hon. Member to the statement of the Field-Marshal's views contained in the dispatch from him which was published on December 29th last. As regards the second and third parts of the question, it would be contrary to public interests to give information as to the types and numbers of aeroplanes being ordered. The hon. Member may rest assured that no machines are being ordered for employment in France which the Commander-in-Chief does not want.

MR. BILLING asked what proportion of British Government designed machines are at present being employed in France and what proportion of private British-designed; what proportion of French-designed; and what proportion of accidents coming under the heading of killed, wounded, or missing are to be attributed to each of these types, respectively, in the last twelve months?

Major Baird: It would not be in the public interest to give the information asked for in the first and second part of the hon. Member's question. The compilation of the figures asked for in the third part of the question would involve a very considerable amount of work, and as it would not furnish the material for a fair comparison, I do not think that the War Office could justifiably be asked to undertake it at the present time of pressure.

## Sale of Service Aeroplanes.

MR. BILLING, on March 22nd, asked the Parliamentary Representative to the Air Board whether he is aware that new aeroplanes are being offered by the administrators of the Royal Flying Corps for sale by private tender; whether any civilian has access to inspect these machines; what is the total number of machines which are being so offered; what types of machines are being so offered; and what is the reason of their being so offered?

Major Baird: Certain aeroplanes are now being offered for sale by private tender. Opportunity for inspection is limited to representatives of schools instructing intending applicants for services approved by the War Office. The total number of machines is eighty-nine, composed of Bleriot, Caudron and short biplanes, Morane monoplanes, and twin Curtiss; of these, thirty-six have been used. The reasons for disposal are, in the great majority of cases,



that the engines which suit these aeroplanes can be better employed in other types.

## Mr. C. Bright's Recommendations.

MR. BILLING asked the Under-Secretary of State for War whether the chairman of the Air Board has had the opportunity of reading the recommendations of Mr. Charles Bright contained in the Air Committee's Report on the administration and command of the Royal Flying Corps; whether he has availed himself of this opportunity; if so, whether he has adopted any of the suggestions contained therein; and whether he has called in the assistance of Mr. Charles Bright to elaborate any recommendations he made in that Report?

Major Baird: My Noble Friend has had the advantage of acquainting himself with the recommendations referred to. The recent changes in the organisation of design and supply of aircraft for the Naval and Military Services to a great extent coincide with some of those recommendations, and it is possible that future action will be taken which will be in accordance with others. Mr. Bright's recommendations are very clearly stated in the Report, and the need for their elaboration has not arisen.

## Wheat Field for Aerodrome.

LORD STRACHIE, in the House of Lords on March 20th, asked the Joint Parliamentary Secretary of the Board of Agriculture whether his attention had been drawn to the statement in *The Times* of the 16th inst., that the military authorities had seized a 22-acre field of fine young wheat and were building hutments upon it, whereas a field of poor grass across the road would serve their purpose equally well; and, if this statement truly represented the facts of the case, whether the Board of Agriculture would represent to the War Office the undesirability of such action by the military authorities in view of the shortage of wheat.

THE DUKE OF MARLBOROUGH, in reply, said the wheat field in question was acquired by the War Office on behalf of the Flying Corps. The authorities informed him that no other field would have served the purpose. This was apparent from the fact that the field fell within the natural lines of boundary of the aerodrome. The wheat field was essential to the aerodrome in order to afford the pupils the possibility of safe landing, and it was also necessary for providing accommodation. The original aerodrome was dangerous for pupils when it was a one-squadron station; now that a second squadron was stationed there the danger was doubled. In fact, the additional squadron could not be stationed there unless the wheat field had been acquired, and the alternative would have been to acquire a new aerodrome, which would have entailed the acquisition of perhaps 200 acres of agricultural land and the expenditure of thousands of pounds on road-making, water supply and other services. He was assured that the field across the road referred to would not have been suitable, because it did not come within the natural lines of boundary. The actual damage done by the acquisition of the field would probably be something like £350. That was considerably less than would have been spent by the nation if the aerodrome had had to be removed to another place, which the authorities assured him would have been necessary if the wheat field had not been acquired.

## Defence Against Zeppelins.

MR. BENNETT-GOLDNEY, on March 26th, asked the Under-Secretary for War—(1) whether, on the night of or the morning following the recent air raid in Kent and elsewhere on Friday, March 16th, any Zeppelin approached within a radius of 10 miles of a certain aerodrome, the name of which has been privately communicated to him; whether the aerodrome referred to is included in the number of Home defence stations which have been officially mentioned as being provided with means, aerial and other, of attacking Zeppelins by night; if so, whether he can explain to the House how it was that during the recent raid above mentioned no aeroplanes were ordered up from this particular aerodrome, although it was brilliantly illuminated during the raid so as to be conspicuous from above for a distance of many miles; if he can give any information as to how many fully trained pilots there were

on duty available at this aerodrome station on the night in question; if he will say whether these pilots, as well as those on duty at the Home defence stations in the neighbourhood of London and elsewhere, had all been trained to make use of the methods of attacking Zeppelins which have proved to be successful; if not, if he can give an assurance that observers who had been so trained were available at these different stations on the night in question; whether there was a sufficiency of suitable aeroplanes and pilots in actual readiness to take up such trained observers at the stations concerned; and (2) whether the Home defence squadrons in the neighbourhood of London and elsewhere, including East Kent, are now after two and a-half years of menace up to their official strength both in pilots and equipment; whether these squadrons are fully equipped with thoroughly efficient and adequately armed aeroplanes; and whether the pilots in such squadrons given the responsibility of flying at night have been fully trained in the successful method now adopted for the destruction of Zeppelins?

Mr. Macpherson: The distribution of aircraft between the various theatres of war and for Home defence is the subject of constant review, and is determined in accordance with the military situation. It is not considered to be in the public interest to give any information as to this distribution. Only pilots trained to night-flying are employed on that duty, and all available night-flying pilots are always ready for duty, and are sent up as the situation demands.

Mr. Pemberton-Billing: Can the hon. gentleman say whether the complete scheme suggested by his predecessor is in working order?

Mr. Macpherson indicated assent.

## The R.F.C. Inquiry Recommendations.

MR. BENNETT-GOLDNEY asked whether the recommendations of the Judicial Parliamentary Air Inquiry, presided over by Mr. Justice Bailhache, have been carried into effect; whether any of the aeroplanes in which our airmen are sent up to fly at night are still of the same type, if not actually the same machines, as those which have been condemned in France as unsuitable for the purpose owing to their liability to engine troubles; if he can say whether any of the aeroplanes now used for night flying in Great Britain are of the type known amongst airmen as dud machines or machines with Royal Aircraft Factory engines with 12 cylinders such as have been condemned in France; and whether any of these machines and engines are still in use in France?

Col. Craig (Treasurer of the Household): My hon. and gallant friend the Parliamentary Secretary to the Air Board (Major Baird) has asked me to reply to this question in his absence. The answer to the first part of the question is that the two major recommendations of the three contained in the main Report have been substantially adopted. The answer to the second part is in the negative; to the third and fourth parts that it is not understood to which type of aeroplane the hon. member refers, but as regards the engine which he mentions that he is incorrect in stating that it has been condemned in France. This type of engine is now in use in France and elsewhere, and the Reports upon it are satisfactory.

Mr. Outhwaite: Can the hon. gentleman say if the engines now being used in France are considered to be satisfactory? If so, can he account for the fact that I have received a letter sent by a young officer who was killed—

Mr. Speaker: The hon. member must wait until the Parliamentary Representative of the Air Board is here.

## Boulogne-sur-Mer Defences.

MR. BENNETT-GOLDNEY asked whether the French Government or the British authorities in France are responsible for the air defence of Boulogne-sur-Mer and other places in the neighbourhood?

Mr. Macpherson: Arrangements have been made for the air defence of Boulogne-sur-Mer and other places in the neighbourhood. It is not in the public interest to give information as to the zones of responsibility of the French and British forces.

## THE ROLL OF HONOUR.

### REPORTED by the War Office:—

#### Killed.

2nd Lieut. G. M. T. Bourne, King's R.R.C., att'd. R.F.C.  
2nd Lieut. D. D. Fowler, R.F.C.  
2nd Lieut. J. Muirhead, R.F.C.  
Lieut. A. A. Murray, Can. Inf., att'd. R.F.C.  
2nd Lieut. E. C. Pashley, R.F.C.  
2nd Lieut. J. Thwaytes, Border, att'd. R.F.C.  
Capt. G. Wenden Border, att'd. R.F.C.

#### Died of Wounds.

2nd Lieut. R. G. Miller, A. and S. Highlrs., att'd. R.F.C.  
Lieut. B. M. Morris, Can. Eng., att'd. R.F.C.

#### Previously reported Missing, now reported Killed.

2nd Lieut. W. P. Bowman, R.W. Kent., att'd. R.F.C.  
2nd Lieut. G. B. J. Firbank, R.F.C.  
Major E. P. Graves, R.F.A., att'd. R.F.C.  
Major L. Parker, R.F.C.  
2nd Lieut. L. G. H. Vernon, M.C., R.F.C.

#### Previously reported Wounded and Missing, now reported Killed.

2nd Lieut. E. W. Flinn, R.F.C.

#### Missing, believed Killed.

2nd Lieut. D. H. Glasson, R.F.C.

#### Wounded.

Lieut. R. C. Allen, R.F.A. and R.F.C.  
2nd Lieut. N. H. Colson, R.F.C.  
Lieut. T. A. Cooch, R.F.C.  
2nd Lieut. R. G. Cox, Worcesters, att'd. R.F.C.  
Lieut. P. H. Davy, R.F.C.  
2nd Lieut. B. Farmer, Buffs (E. Kent), att'd. R.F.C.  
Lieut. S. Guillon, Can. Inf., att'd. R.F.C.  
Capt. G. Holland, R.F.C.  
2nd Lieut. F. R. Hudson, R.F.C.  
2nd Lieut. W. D. Matheson, R.F.C.

2nd Lieut. R. N. L. Munro, R.F.C.  
Lieut. A. S. N. O'Brien, R.F.A., att'd. R.F.C.  
2nd Lieut. I. W. Parnell, R.F.C.  
2nd Lieut. H. E. Ward, R.F.C.  
14394 2nd Air Mech. E. Baker, R.F.C.

#### Previously reported Prisoner of War, now reported Wounded and Prisoner of War in German hands.

2nd Lieut. H. B. O. Mitchell, R. Inniskilling F., att'd. R.F.C.

#### Missing.

2nd Lieut. A. Appleton, R.F.A. and R.F.C.  
Lieut. A. E. Boulthbee, Northampton, att'd. R.F.C.  
Capt. E. W. Bowyer-Bower, E. Surrey, att'd. R.F.C.  
2nd Lieut. A. L. Constable, R.F.C.  
2nd Lieut. R. W. Cross, R.F.C.  
2nd Lieut. C. R. Dougall, A. and S. Hdrs. and R.F.C.  
2nd Lieut. A. I. Gilson, R.F.C.  
2nd Lieut. S. Harryman, Gloucester, att'd. R.F.C.  
2nd Lieut. T. W. Jay, R.F.C.  
2nd Lieut. C. D. Knox, Suffolk, att'd. R.F.C.  
2nd Lieut. E. W. Lindley, Manchester and R.F.C.  
Lieut. C. F. Lodge, Worcester and R.F.C.  
2nd Lieut. R. H. Lownds, R.F.C.  
2nd Lieut. J. C. Rimer, R.F.C.  
Capt. G. S. Thorne, R.F.C.  
2nd Lieut. P. E. H. Van Baerle, W. Yorks. and R.F.C.  
2nd Lieut. F. H. Wilson, R.F.C.

#### Previously reported Missing, now reported Prisoner of War in German hands.

Capt. O. Greig, R.F.C.

#### Previously reported Missing, now reported Prisoner of War in Turkish hands.

Lieut. A. J. Lazarus-Barlow, Yeo. and R.F.C.

#### Previously reported Missing, now reported Missing, believed Prisoner of War in Bulgarian hands.

2nd Lieut. A. C. Stopher, R. Welsh F., att'd. R.F.C.



# THE SCREW PROPELLER IN AIR.

By M. A. S. RIACH.

(Continued from page 275.)

## R. E. FROUDE'S THEORY.

I now propose to deal with the R. E. Froude hypothesis of screw propulsion in fluids and its application to the present theory of the airscrew. Using the same symbols as those already defined, we commence by considering the thrust and efficiency of an annulus at a radius of  $(x)$  from the boss centre. The thrust contributed by the annulus is due to the change in momentum per second of the fluid passing through the actuator disc at the radius under consideration.

In the paper contributed by Mr. R. E. Froude to the Institution of Naval Architects in 1889, it is shown that the thrust of such a propulsive system as that contemplated in the action of the screw propeller is equal to the product of the mass per second of fluid passing through the actuator and the difference in velocity between the slip or wake stream and the translational velocity of the screw through the fluid. That is the thrust on an annulus is given by

$$T = M \cdot (V_1 + V_2) = M \cdot V_1 \cdot \left(1 + \frac{V_2}{V_1}\right)$$

It may be shown that, on R. E. Froude's assumption of the total work done per second being equal to the gain in kinetic energy of the slip stream, the added slip velocity  $(V_2)$  is equal to the inflow velocity  $(V_1)$ , i.e.,  $(V_2/V_1)$  is equal to unity. For the present, however, I prefer to keep this ratio in its algebraical form, and it necessary to substitute for its values other than unity as occasion may determine.

Now the area of the annular ring element at radius  $(x)$  is  $(2\pi \cdot x \cdot dx)$ , and consequently, if the whole of this area be assumed to be operated in producing the thrust, we can write:—

Mass per second through annulus  $= \rho \cdot 2\pi x \cdot dx \cdot (V + V_1)$  and this must be for continuity of motion the value of the mass of fluid passing any given point in the streams ahead and behind the screw per second. Hence, if we introduce a coefficient  $(q)$  to represent the fraction of the annular ring element employed, we have

$$M = q \cdot \rho \cdot 2\pi x \cdot dx \cdot (V + V_1)$$

and therefore the thrust on the annulus becomes

$$T = q \cdot \rho \cdot 2\pi x \cdot dx \cdot (V + V_1) \cdot V_1 \cdot \left(1 + \frac{V_2}{V_1}\right)$$

and if  $(q)$  is equal to unity, then the whole ring area is assumed to be operative, and if the ratio  $(V_2/V_1) = 1$ , on R. E. Froude's theory we obtain:—

$$T = \rho \cdot 4\pi x \cdot dx \cdot (V + V_1) \cdot V_1$$

and the only unknown quantity is then  $(V_1)$ .

If  $(V_1)$  remained constant over the whole screw disc, we could integrate the above equation and obtain the total thrust on the screw from the formula:—

$$T = \frac{\rho \cdot \pi \cdot d^2 \cdot V_1 \cdot (V + V_1)}{2}$$

so that if

$$\begin{aligned} \rho &= .00238 \\ V &= 100 \\ V_1 &= 20 \\ d &= 8 \end{aligned}$$

we get the total thrust equal to 540 lbs. On the other hand, if  $(V_2/V_1) = 0$ , an extreme condition contemplated by Mr. F. W. Lanchester,\* the thrust of the screw is halved, i.e., 270 lbs.

Again, the efficiency of the annulus is obtained from

$$\eta = \frac{\text{thrust} \times V}{\text{thrust} \times (V + V_1)} = \frac{V}{V + V_1}$$

and this is on the assumption of a frictionless fluid. This efficiency formula may also be written in the form:—

$$\eta = \frac{\tan A}{\tan A_1}$$

where  $(A)$  and  $(A_1)$  have the values already defined.

Now, comparing this formula of R. E. Froude with that already obtained from the blade element theory, viz.:—

$$\rho = \frac{\tan A}{\tan (A_1 + \gamma_1)}$$

we notice that the two formulæ become identical when  $(\gamma_1)$  is equal to zero, i.e., when there is no drag in the R. E. Froude hypothesis of a frictionless fluid.

## THE TWO METHODS COMBINED.

Having thus briefly enunciated the two methods of attacking the problem, I propose to combine them by equating the

\*"A Contribution to the Theory of Propulsion and the Screw Propeller," by F. W. Lanchester. Trans. I.N.A., 1915.

two expressions for the thrust on an element obtained from each. This will then give the lift coefficient  $(cy_1)$  of the section at  $(x)$  in terms of  $(V_1)$  the inflow velocity, that is, in terms of  $(a_1)$  the real angle of attack.

A graph of the lift coefficient may then be plotted against the angle of attack, and by superposing the graph obtained from the wind channel for the section considered as an aerofoil, we obtain the true values of the lift coefficient and inflow velocity at the radius under consideration. This is evident when it is considered that the lift coefficient is a function of the angle of attack or angle of incidence, and that in consequence were the form of this function known analytically we might substitute for it in the formula obtained by equating the thrusts and thus solve for both of these variables at once. The graphical method is employed owing to the fact that the analytical form of functions of this kind are usually difficult to determine accurately.

The method of procedure is as follows:—

The geometrical blade element aerofoil expression for the thrust is

$$N \cdot dT_1 = N \cdot cy_1 \cdot \rho \cdot b \cdot dx \cdot 4 \cdot \pi^2 \cdot n^2 \cdot x^2 \cdot \sec A_1 \cdot [1 - \tan A_1 \cdot \tan \gamma_1]$$

where  $(N)$  denotes the number of blades employed, and the momentum change expression on R. E. Froude's theory is

$$T = q \cdot \rho \cdot 2\pi x \cdot dx \cdot V_1 \cdot (V + V_1) \cdot \left(1 + \frac{V_2}{V_1}\right)$$

$$= \left(1 + \frac{V_2}{V_1}\right) \cdot q \cdot \rho \cdot 2\pi x \cdot dx \cdot (2\pi \cdot n \cdot x)^2 \cdot \tan A_1 \cdot [\tan A_1 - \tan A]$$

in terms of  $(A)$  and  $(A_1)$ . So that equating the two expressions we obtain

$$cy_1 = \frac{q \cdot 2\pi x \cdot \left(1 + \frac{V_2}{V_1}\right) \cdot \sin A_1 \cdot [\tan A_1 - \tan A]}{N \cdot b \cdot [1 - \tan A_1 \cdot \tan \gamma_1]}$$

which is the expression sought and which, when employed in conjunction with the wind channel graph of  $(cy_1)$  against  $(a_1)$ , is sufficient to solve for both of these variables.

The two empirical unknown factors in the above equation are  $(q)$  and  $(V_2/V_1)$ .

## EXPERIMENTAL VERIFICATION.

We may, I think, for a first estimate take both  $(q)$  and  $(V_2/V_1)$  as being equal to unity. That is, we assume that the full ring area of the annulus is utilised, and that R. E. Froude's law holds with regard to the relative values of  $(V_1)$  and  $(V_2)$ , in other words that one half the acceleration is precedent and one half antecedent to the propeller.

Now consider for a moment the effect on the formula just established of keeping the quantity  $(V/n \cdot d)$ , the pitch ratio, a constant. It is immediately apparent that if  $(V/n \cdot d)$  remains constant then for any given radius  $(x)$  the following remain constant also— $(q)$ ,  $(V_2/V_1)$ ,  $(b)$ ,  $(A)$ ,  $(\phi)$ , and also the following are constant— $(d)$ ,  $(N)$ . So that the curve plotted of  $(cy_1)$  against  $(a_1)$  will also remain constant, as will also the wind channel curve superimposed on this curve, since the section is constant. Hence, the points of intersection of these two curves will also remain constant, that is that  $(A_1)$  is constant, and therefore

$$\frac{\tan A_1}{\tan A} = \frac{V + V_1}{V}$$

is constant also.

We thus arrive at the result that, for a given value of  $(V/n \cdot d)$ , the ratio of the velocity of the fluid through the actuator disc to the velocity of the undisturbed fluid remains a constant. This result has been established experimentally by G. Eiffel in his tests on model airscrews.†

We thus have in the above example a direct comparison between the results given by the theory, and those obtained by experiment, and it is gratifying to know that in this case experimental results fully confirm theory. It is especially interesting to analyse an existing propeller and to find the changes in thrust, work and efficiency which are obtained by alteration of one or more of the propeller characteristics.

Let Fig. 4 denote the two graphs of  $(cy_1)$  against  $(a_1)$  for a given radius  $(x)$  for some particular type of propeller.

Then the expressions for thrust and efficiency on the element are:—

$$dT_1 = cy_1 \cdot \rho \cdot b \cdot dx \cdot 4 \cdot \pi^2 \cdot n^2 \cdot x^2 \cdot \sec A_1 \cdot [1 - \tan A_1 \cdot \tan \gamma_1]$$

and

$$\rho = \frac{\tan A}{\tan (A_1 + \gamma_1)}$$

Now examine the graph given in Fig. 4, and suppose the section of the blade to remain constant while the blade width is increased. The chord angle  $(\phi)$  also remaining constant

† "Nouvelles Recherches sur la Résistance de l'Air et l'Aviation," 1914.



throughout, so that variation in  $(A_1)$  is obtained by variation in  $(a_1)$ . Then if we double the blade width, we halve the ordinates of curve (1), and since curve (2) remains constant

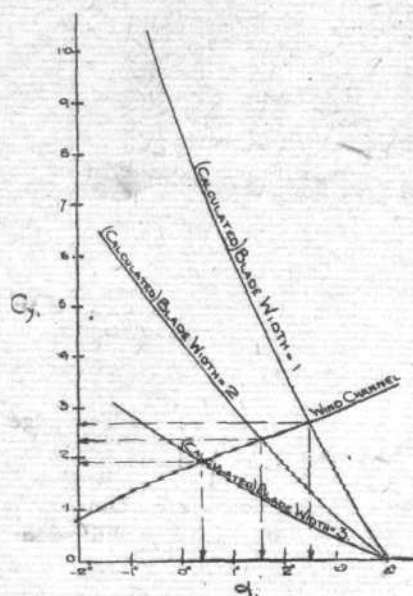


Fig. 4.

to the higher inflow velocity  $(V_1)$  and consequently smaller angle of attack  $(a_1)$ . It may, it is true, be argued that if  $(V_1)$  be increased, then the thrust must correspondingly increase, and in fact this is a necessary condition providing that the ratio  $(V_2/V_1)$  remains constant throughout.

I shall endeavour to show, however, that the ratio  $(V_2/V_1)$  is by no means to be regarded as a remaining constant for changes in angle of attack  $(a_1)$ , and that for small or negative angles of attack this ratio may conceivably become zero or even negative, depending upon the pressure distribution round the blade section at the angle of attack  $(a_1)$  considered.

Turning now to the efficiency of the element denoted by

$$\frac{\tan A}{\tan (A_1 + \gamma_1)}$$

it is evident that as the blade width is increased, both  $(A_1)$  and  $(\gamma_1)$  are increased, thus reducing the efficiency—a result again in accordance with experience of marine screws. On the other hand it is evident that the efficiency with wide blades may be considerably improved by increasing the chord angle of the blade  $(\phi)$  so as to give to the angle of attack of the section a value corresponding to a minimum value of  $(\gamma_1)$ . In this case, therefore, the efficiency of the element is increased by increasing the so-called slip angle of the screw. This result is again in accordance with experiment on marine propellers.

## EXTENSION OF THE THEORY.

We may, I think, roughly divide a propeller blade into three parts, the boss, the tip and the centre forming the main portion of the blade. It is usual, I believe, when designing propellers on the old aerofoil theory to choose for the sections an average aspect ratio of say six, and then to employ a correction factor obtained by experiment in determining the blade widths along the blade. This process, however, seems to be open to objection from various sources. It is well known that the pressure distribution along the span of any aerofoil, such as an aeroplane wing for instance, does not remain constant but varies from a maximum intensity in the middle of the span to a minimum at the wing tips, and it is this fact of tip losses which makes the high aspect ratio aerofoil more economical than one of lower aspect ratio.

The same consideration should apply to the blades of an airscrew, where each individual blade can be treated as a separate aerofoil, and where in consequence the end losses—in this case those of the boss and tip—must be taken into account in estimating the thrust, work and efficiency. The

boss conditions in this case may probably be ignored as being very small; the tip losses form, however, a fundamental link in the chain of analysis and in consequence require most careful consideration.

The exact analogy between the pressure distribution along the span of an aerofoil considered as an aeroplane wing, and considered as a blade of a screw propeller, does not appear to be immediately capable of demonstration. As a first estimate, however, I have assumed the maximum intensity of pressure to occur at about the centre of the blade, i.e., at a radius of  $\frac{1}{2}$  diameter, and to fall off to a minimum value at the boss and tip—that is, I consider the propeller blade as the equivalent of an aeroplane wing of infinite span revolving about one of its wing tips. Under these assumptions then it is possible to form some idea of the relative changes in lift and lift/drag which occur as we proceed along the blade from the boss to the tip. So that if, when analysing any existing airscrew, we apply the theory of inflow already enunciated under the conditions imposed by the pressure distribution change considered above, we shall, I think, be in a position to form a fairly correct picture of the actual conditions under which the blades are working, and hence be in a position to estimate the probable values of the thrust, work and efficiency, with a much larger measure of success than by the older method in which such refinements as those outlined here are ignored.

There is still the question of the values of the ratio  $(V_2/V_1)$  to be allotted to the various sections along the blade of the airscrew, as it may be taken for granted, I think, that this ratio not only does not remain constant over the entire surface of the screw disc, but that its numerical value may usually be taken as considerably less than unity, and sometimes even zero or negative.

That values other than unity have been considered not only possible, but probable for this ratio by authorities on the marine screw propeller, may be gauged from the following remarks by D. W. Taylor on the discussion of Mr. R. E. Froude's 1911 paper.

Mr. D. W. Taylor said: "It is true that the experimental causes appear to indicate that the acceleration takes place mostly forward of the screw, and is not equally divided between forward and aft, as deduced by Mr. Froude for his actuator. . . . This indication that with actual propellers the greater portion of the fore and aft acceleration of the water takes place forward of the screw," &c.

It appears to me in this connection not unreasonable to regard this  $(V_2/V_1)$  ratio as equal to the ratio of the lower and top pressures on an aerofoil section, and if this be applied to all radii along the blade we are immediately in a position to analyse any given airscrew blade under any set of conditions. For instance, to take as an example the case of the section under the conditions when giving no thrust.

$$\text{Then } dT_1 = L_1 \cos A_1 - D_1 \sin A_1 = 0 \\ \text{and } \therefore \frac{D_1}{L_1} = \tan \gamma_1 = \cot A_1$$

and if  $(\phi)$  is known, then we can solve for  $(a_1)$ , since  $(\gamma_1)$  is known from the wind channel curve.

$$\text{But if } dT_1 = 0, \text{ then } V_1 \left(1 + \frac{V_2}{V_1}\right) = 0,$$

and hence either  $(V_1)$  is equal to zero or  $(V_2/V_1)$  is equal to minus unity. In the first case, there is no inflow, and in the second case the top pressure is numerically equal to the under surface pressure, but acts in an opposite direction, and in this case the angle of attack  $(a_1)$  of the section would be probably negative.

Now, tests on aerofoils show that the pressure distribution at about  $(-2^\circ)$  is about the same numerically on top and bottom surfaces, but that the bottom surface pressures act in an opposite direction to the usual at positive angles of incidence.

These facts appear to bear out the statement that  $(V_2/V_1)$  may have a negative value.

(To be continued.)

## Air Work in the Advance.

THE expert French commentator, writing on March 22nd, said:—"Despite bad weather, there was considerable air activity in the zone of the enemy's retreat. French and British aviators furnished their general staffs with most valuable information, and successfully drove off many enemy machines. One of the aviators bagged was Prince Frederick Karl of Prussia."

The correspondent of the *Petit Journal*, writing on March

19th, said that the British aeroplanes were doing remarkably good work in the pursuit.

Mr. W. Beach Thomas, writing to the *Daily Mail* from the War Correspondents' Headquarters in France on March 20th, said:—"Our airmen once again, as behind High Wood long ago, saved a group of cavalry from destruction by their machine guns, and German airmen, who have been active, thought it worth while to dive and attack with machine-gun fire two staff officers bicycling forward for observation purposes."



# The British Air Service

"PER ARDUA AD ASTRA"

UNDER this heading are published each week the official announcements of appointments and promotions affecting the Royal Naval Air Service and the Royal Flying Corps (Military Wing) and Central Flying School. These notices are not duplicated. By way of instance, when an appointment to the Royal Naval Air Service is announced by the Admiralty it is published forthwith, but subsequently, when it appears in the LONDON GAZETTE, it is not repeated in this column.

## Royal Naval Air Service.

Admiralty, March 21st.

S. E. Bowyer and F. C. Lea granted temp. commissions as Lieut., R.N.V.R., seniority Mar. 20th and Mar. 17th respectively.

Temp. Sub-Lieut. (R.N.V.R.) A. D. Newbury promoted to Temp. Lieut., seniority Mar. 20th.

J. H. Narbert granted temp. commission as Sub-Lieut., R.N.V.R., seniority Mar. 19th.

The following Temp. Prob. Flight Officers promoted to Temp. Flight Sub-Lieut., seniority as stated: J. W. Beebe, Feb. 21st; D. Hammond, Jan. 21st; N. H. Woodhead, Nov. 21st; J. H. Thompson, Dec. 7th; M. W. W. Eppstein, Dec. 14th; W. Allaway, Feb. 28th; and A. D. Carey, Nov. 14th.

Admiralty, March 22nd.

L. A. C. Stafford entered as Temp. Lieut., R.N.V.R., and appointed to "President," additional, for R.N.A.S., date Mar. 19th.

B. A. Woods granted temp. commission as Sub-Lieut., R.N.V.R., and appointed to "President," additional, for R.N.A.S., seniority Mar. 3rd.

C. Hayes entered as Temp. Sub-Lieut., R.N.V.R., and appointed to "President," additional, for R.N.A.S., date Mar. 20th.

Admiralty, March 24th.

N. F. W. Paul granted a temp. commission as Lieut., R.N.V.R., seniority Mar. 23rd.

R. Davidson granted a temp. commission as Sub-Lieut., R.N.V.R., seniority Mar. 23rd.

Mid. (R.N.) H. Viney granted temp. commission as Sub-Lieut., R.N.V.R., and appointed to "President," additional, for R.N.A.S., date April 1st.

Clerk (R.N.) A. C. Getley graded in R.N.A.S. as Temp. Prob. Flight Officer, date Mar. 23rd.

## Royal Flying Corps (Military Wing).

London Gazette Supplement, March 17th.

**Flying Officers.**—Feb. 5th: Lieut. W. H. Williams, Lan. Fus. (T.F.), and to be sec'd.; Temp. 2nd Lieut. L. E. Francis, R.W. Surr. R. Feb. 15th: 2nd Lieut. A. C. Dunlap, R.E. (T.F.), and to be sec'd.; Temp. 2nd Lieut. W. J. Clifford, Gen. List, from a Flying Officer (Ob.), with seniority from May 30th; Temp. 2nd Lieut. B. B. Lemon, Gen. List; Temp. 2nd Lieut. M. Topham, Gen. List; and Lieut. S. F. Brown, S.R.; Temp. 2nd Lieut. N. P. Henderson, Gen. List. Feb. 22nd: Temp. Lieut. W. A. de L. Y. Bainbridge, Bord. R., and to be transfd. to Gen. List; Lieut. E. F. Ambler, Lond. R. (T.F.), and to be sec'd.; Temp. 2nd Lieut. J. E. Doyle, A.S.C., and to be transfd. to Gen. List; Feb. 23rd: Temp. 2nd Lieut. (Temp. Lieut.) J. B. Tait, Gen. List, from a Flying Officer (Ob.), with seniority from May 31st; and Lieut. (Temp. Lieut.) W. Harle, Northd. Fus. (T.F.), from a Divl. Sig. Co., R.E. (T.F.), and to be sec'd.; Temp. 2nd Lieut. (on prob.) R. H. Latham, Gen. List. Feb. 25th: Lieut. F. C. B. Saville, D. of Corn. L.I., and to be sec'd.; and Lieut. F. J. Marsden, Yeo. (T.F.), and to be sec'd.; Temp. 2nd Lieut. E. P. Hughes, Gen. List. Feb. 26th: Lieut. C. Patteson, M.C., S. Wales Bord., and to be sec'd.; Temp. 2nd Lieut. R. M. K. Denning, S. Staff. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. J. D. Atkinson, R.E.; Temp. 2nd Lieut. (on prob.) C. A. Farquharson, Gen. List; Temp. 2nd Lieut. (on prob.) L. A. Weston, Gen. List. Feb. 27th: 2nd Lieut. (Temp. Lieut.) F. W. Winterbotham, Yeo. (T.F.), and to be sec'd.; Temp. 2nd Lieut. C. Street, Gen. List, from a Flying Officer (Ob.), with seniority from Sept. 17th; Temp. 2nd Lieut. R. G. R. Townsend, Gen. List; Temp. 2nd Lieut. (on prob.) N. MacMillan, Gen. List. Feb. 28th: Temp. Lieut. R. W. Dobbie, attd. High. L.I. and to be transfd. to Gen. List; 2nd Lieut. (Temp. Lieut.) J. C. Woollett, R.F.A. (T.F.), and to be sec'd.; and Lieut. G. L. Lloyd, Yeo. (T.F.), and to be sec'd.; and Lieut. W. H. Crundall, R.E. (T.F.), from attd. R.E. (T.F.), and to be sec'd.; Temp. 2nd Lieut. A. S. Thompson, attd. R. War. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. H. Smither, Gen. List; Temp. 2nd Lieut. (on prob.) W. P. T. Watts, Gen. List.

**Equipment Officers, 3rd Class.**—Temp. Capt. (Temp. Major) C. K. Butler-Stoney R.F.C. (T.F.); Feb. 21st. Temp. 2nd Lieut. (on prob.) C. Atkey, Gen. List; Feb. 25th. Temp. 2nd Lieut. (on prob.) C. J. Miln, Gen. List; Feb. 28th.

**Memoranda.**—Sergt-Major J. R. Nicholls, from R.F.C., to be 2nd Lieut. for duty with R.F.C.; Mar. 18th. Temp. 2nd Lieut. (on prob.) R. Ritchie is confirmed in his rank. S. M. Pemberton, late Temp. 2nd Lieut., to be Temp. 2nd Lieut. (on prob.) for duty with R.F.C.; Dec. 28th. (Substituted for the notification in the Gazette of Feb. 24th.)

**Supplementary to Regular Corps.**—2nd Lieut. (on prob.) H. Townend is dismissed the Service by sentence of a General Court-martial; Feb. 2nd. R. S. Wakeford to be 2nd Lieut. (on prob.); Sept. 23rd.

London Gazette Supplement, March 19th.

**Flying Officers.**—Temp. 2nd Lieut. G. H. Palmer, Gen. List; Feb. 12th. Temp. 2nd Lieut. N. E. Barracough, Gen. List; Feb. 18th. Feb. 24th: 2nd Lieut. (Temp. Lieut.) C. F. Bailey, Lond. R. (T.F.), and to be sec'd.; and Lieut. (Temp. Lieut.) D. C. Knott, Hamps. R. (T.F.), and to be sec'd. Feb. 26th: 2nd Lieut. W. H. Ryder, Yeo. (T.F.), and to be sec'd.; Temp. 2nd Lieut. J. Robertson, Durh. L.I., and to be transferred to Gen. List; 2nd Lieut. J. C. C. Piggott, D. of Corn. L.I., and to be sec'd.; and Lieut. G. B. McMichael, Hereford R. (T.F.), and to be sec'd.; and Lieut. P. Sellers, Worc. R., and to be sec'd.; Temp. 2nd Lieut. (on prob.) J. G. H. Frew, Gen. List; 2nd Lieut. (on prob.) A. d'A. Sutherland, S.R.; and Lieut. A. G. Davidson, Gord. Highrs., (T.F.), and to be sec'd.; and Lieut. G. B. C. Way, S. Lan. R., and to be sec'd. Feb. 27th: Lieut. G. F. Brady, R. War. R., S.R., and to be sec'd.; 2nd Lieut. (Temp. Lieut.) M. Campbell, R. W. Kent R. (T.F.), and to be sec'd.; Temp. 2nd Lieut. C. R. Alston, S. Lan. R., and to be transfd. to Gen. List; 2nd Lieut. J. Cairns, R.E. (T.F.), and to be sec'd.; Temp. 2nd Lieut. D. Gordon, Gen. List; 2nd Lieut. (Temp. Capt.) W. H. Costello, R.G.A. (T.F.), and to be sec'd.; Temp. Lieut. S. F. P. Polhill, Gen. List, from a Flying Officer (Ob.), with seniority from Aug. 16th; and Lieut. W. M. Staniforth, Yeo. (T.F.), and to be sec'd.; Temp. 2nd Lieut. (on prob.) J. A. Craig, attd. R. Fus., and to be transfd. to Gen. List; Temp. 2nd Lieut. (on prob.) H. R. Parry, attd. Ches. R., and to be transfd. to Gen. List; and Lieut. P. S. Leigh, S.R.

**Equipment Officers, 1st Class.**—Lieut. (Temp. Capt.) J. R. M. Stanfield, R.E. (T.F.), from a Staff Capt., to retain his temp. rank whilst so employed, and to be sec'd.; Mar. 1st.

**3rd Class.**—2nd Lieut. J. E. J. Crawford, S.R.; Jan. 30th. 2nd Lieut. J. W. Parkinson, S.R.; Feb. 10th. 2nd Lieut. F. Ryder, S.R.; Feb. 11th. The appointment of Temp. Lieut. H. J. Gilbert, A. Ord. Dept., notified in the Gazette of Feb. 27th, is antedated to Jan. 1st.

**Supplementary to Regular Corps.**—2nd Lieut. (on prob.) J. Dooxey-Parkinson is removed from the Army, the King having no further occasion for his services as an Officer; Mar. 20th.

London Gazette, March 20th.

**Flying Officers.**—Temp. 2nd Lieut. (on prob.) A. B. Coupal, Gen. List; 2nd Dec. Lieut. (Temp. Capt.) G. A. R. Spain, Ind. Army, from a Flying Officer (Ob.); 16th Feb., seniority 1st Dec., 1915. Feb. 23rd: 2nd Lieut. (on prob.) (Temp. Lieut.) G. Leckie, R.G.A., S.R., from a Flying Officer (Ob.), seniority 21st Feb., 1916; 2nd Lieut. I. Gregory, R.F.A. (T.F.), and to be sec'd.; and Lieut. E. W. Hallam, Yeo. (T.F.), and to be sec'd.; Temp. 2nd Lieut. (on prob.) R. Littlejohn, Gen. List; Feb. 25th. Feb. 27th: Temp. 2nd Lieut. (on prob.) F. C. Parkes, R.E., S.R.; 2nd Lieut. (on prob.) G. W. Armstrong, S.R.; Temp. 2nd Lieut. (on prob.) G. E. Brookes, Gen. List. Feb. 28th: Lieut. A. W. B. Miller, K.O. Sch. Bord., and to be sec'd.; Lieut. S. W. Williams, Essex R. (T.F.), from Mach. Gun Corps, and to remain sec'd.; 2nd Lieut. H. Tennant, Dns., and to be sec'd.; 2nd Lieut. B. Scott-Foxwell, Yeo. (T.F.), and to be sec'd.; and Lieut. (Temp. Lieut.) D. Y. Hay, R.W. Kent R. (T.F.), and to be sec'd.; Temp. Lieut. H. M. Ferreira, Training Res. Bn., and to be transferred to Gen. List; Temp. 2nd Lieut. G. C. Heseltine, Gen. List, from a Flying Officer (Ob.), seniority July 15th; 2nd Lieut. J. A. Pullan, Durh. L.I., S.R.; and Lieut. (on prob.) C. R. Sloan, S.R. Temp. 2nd Lieut. (Temp. Lieut.) H. Hamer, Gen. List, from a Flying Officer (Ob.); Feb. 14th, seniority April 1st. Lieut. F. R. G. Milton, M.C., R.A., from a Flying Officer (Ob.); Feb. 23rd, seniority April 18th. 2nd Lieut. A. R. James, Yeo. (T.F.), and to be sec'd.; Feb. 23rd. 2nd Lieut. W. Roger, Arg. and Suthd. Highrs. (T.F.), and to be sec'd.; Feb. 27th. Feb. 28th: Temp. Lieut. A. V. Quinell, L'pool. R., from Temp. Capt., Serv. Bn.; 2nd Lieut. F. A. V. Cook, Durh. L.I. (T.F.), and to be sec'd.; Temp. 2nd Lieut. C. W. Langlands, Gen. List.

**Flying Officers (Observers).**—Temp. 2nd Lieut. J. G. Coombe, Linc. R., and to be transfd. to Gen. List; Nov. 15th, seniority May 14th. Feb. 21st: Temp. 2nd Lieut. L. Neville-Smith, Gen. List, seniority Oct. 15th; Lieut. R. Mayberry, R. Sc. Fus., S.R., and to be sec'd., seniority Nov. 5th. Temp. Lieut. E. D. Jones, A. Cyclist Corps, and to be transfd. to Gen. List; Feb. 22nd, seniority Nov. 23rd. Feb. 22nd, seniority Nov. 25th: 2nd Lieut. (Temp. Lieut.) H. O. Nickalls, Yeo. (T.F.), from Brig. Sig. Troop, Yeo. (T.F.); Temp. 2nd Lieut. M. A. S. Vaile, Northn. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. A. J. E. Etches, attd. E. York. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. (on prob.) J. Fleming, Gen. List. Feb. 22nd: 2nd Lieut. G. W. B. Hampton, Suff. R. (T.F.), and to be sec'd., seniority Dec. 4th; Temp. 2nd Lieut. B. S. Lister, N. Staff. R., and to be transfd. to Gen. List, seniority Dec. 22nd; and Lieut. F. H. L. Varcoe, M.C., Middx. R. (T.F.), from attd. Glouc. R. (T.F.), and to be sec'd., seniority Dec. 26th; and Lieut. W. O. Hatcher, Sco. Rif., and to be sec'd., seniority Dec. 28th; Lieut. (acting Capt.) J. W. Rayner, Northd. Fus., S.R., and to relinquish his acting rank, seniority Jan. 18th; 2nd Lieut. (Temp. Capt.) B. E. Sutton, M.C., Yeo. (T.F.), from Adj.; Sept. 27th, seniority Feb. 2nd, 1916. The seniority of Temp. 2nd Lieut. H. J. Bennett, Gen. List, is Jan. 14th, and not as stated in the Gazette of Mar. 7th.

**Balloon Officers.**—Temp. 2nd Lieut. H. G. Kirk, Glouc. R., and to be transfd. to Gen. List; Nov. 21st, seniority July 31st. Temp. Lieut. S. Wright, M.C., R.E.; Jan. 2nd, seniority July 5th.

**Equipment Officer, 1st Class.**—The appointment of Lieut. (Temp. Capt.) R. K. Pillers, Northn. R., S.R., notified in the Gazette of Feb. 21st, is antedated to Dec. 6th.

**Memoranda.**—To be Temp. 2nd Lieut.: Sergt. J. Bennett, from R.F.C., for duty with R.F.C.; Feb. 23rd. D. R. Morford (on prob.), for duty with R.F.C.; Mar. 9th.

**Supplementary to Regular Corps.**—2nd Lieut. L. M. McCoy resigns his commission; Mar. 21st. The under-mentioned to be 2nd Lieuts. (on prob.): A. W. Judge; Mar. 7th. H. P. Beasley; Mar. 8th. Mar. 9th: C. F. Gorringer, C. E. Wykes. Mar. 10th: V. M. Adamson, C. E. Amore, A. R. B. Gill, W. Brackenbury, T. Campbell, A. Chapple, J. E. Dawes, F. J. Farlow, R. J. Fetherston, L. E. Heather, R. B. Hutchings, P. H. Harbutt, C. B. Hudson, D. H. Kemp, D. Low, I. Massey, D. G. Moreton, E. A. Masters, A. C. Nixon, T. A. Peddell, W. Searle, R. J. Shanks, J. W. Tattersall, F. Walters.

London Gazette Supplement, March 21st.

**Special Appointments.**—Graded as a Sqdn. Com.: Capt. G. H. Cox, N. Staff. R., S.R., a Flight-Com., and to be Temp. Major whilst so employed; Mar. 1st. Graded as a Flight-Com.: Lieut. G. MacD. Turner, York. R. (T.F.), a Flying Officer, and to be Temp. Capt. whilst so employed; Mar. 1st.

**Flight-Commanders.**—From Flying Officers, and to be Temp. Capt. whilst so employed:—Mar. 4th: 2nd Lieut. F. N. Hudson, M.C., E. Kent R.; and Lieut. R. C. M. Smith, S.R. Temp. Lieut. J. K. Summers, Gen. List. Mar. 8th. From Flying Officers: Capt. L. S. Platt, Lrs.; Mar. 6th. Temp. 2nd Lieut. (Temp. Lieut.) J. B. Graham, Gen. List, and to be Temp. Capt. whilst so employed; Mar. 11th.

**Flying Officers.**—2nd Lieut. J. B. McCudden, Gen. List; Jan. 1st. 2nd Lieut. (on prob.) G. Davis, R.F.A. (T.F.), and to be sec'd.; Feb. 23rd. Temp. 2nd Lieut. F. M. Green, Gen. List, from attd. R.E.; Feb. 25th. Temp. Capt. V. F. Davies, A.S.C., and to be transfd. to Gen. List; Feb. 26th. Feb. 27th: 2nd Lieut. (Temp. Capt.) L. C. Coates, Lond. R. (T.F.), and to be sec'd.; Lieut. D. S. Weld, Can. Gen. List; and Lieut. C. S. Ramsay, R.E. (T.F.), and to be sec'd. Feb. 28th: Temp. 2nd Lieut. W. M. B. Skinner, attd. Bedf. R. and to be transfd. to Gen. List; Temp. 2nd Lieut. J. S. Black, Gen. List. Mar. 1st: 2nd Lieut. (Temp. Lieut.) A. D. Pryor, Camb. R. (T.F.), and to be sec'd.; and Lieut. (Temp. Lieut.) O. D. Maxted, E. Kent R. (T.F.), and to be sec'd.; Temp. 2nd Lieut. W. Durrand, Gen. List; and Lieut. D. Stross, R.F.A. (T.F.), and to be sec'd.; Temp. 2nd Lieut. (on prob.) G. H. Boorne, Gen. List; 2nd Lieut. W. Laidler, R.F.C. (T.F.), and to be sec'd.; Mar. 8th.

**Balloon Company Commander.**—Graded as a Flight-Com.: 2nd Lieut. (on prob.) (Temp. Lieut.) E. L. B. Buchanan, R.F.A., S.R., from a Balloon Com. (graded as a Balloon Officer), and to be Temp. Capt. whilst so employed; Feb. 26th.

**Equipment Officers, 2nd Class.**—Capt. L. S. Metford, S.R., from a Flight-Com.; Mar. 7th.

**3rd Class.**—Temp. 2nd Lieut. G. H. Heys, attd. Manch. R., and to be transfd. to Gen. List; Dec. 7th. 2nd Lieut. J. E. Bottomley, Wilts. R. (T.F.), and to be sec'd.; Jan. 25th. Temp. Lieut. D. O'B. Gill, R.E.; Jan. 28th. 2nd Lieut. (on prob.) S. V. Green, S.R.; Feb. 8th. Temp. 2nd Lieut. (on prob.) G. Carr, R.A., and to be transfd. to Gen. List; Feb. 18th. 2nd Lieut. H. P. Reid, S.R., from a Flying Officer; Mar. 6th. The appointment of Temp. 2nd Lieut. G. H. Wilson, Gen. List, notified in the Gazette of Feb. 2nd, is cancelled. The rank of 2nd Lieut. E. W. Lawrence, Gen. List, is as now described and not as in the Gazette of Mar. 3rd.



## Schools of Military Aeronautics.

**Assistant Instructor (graded as an Equipment Officer, 2nd Class).—**2nd Lieut. G. A. Hilliar, Glouc. R., an Equipment Officer, 3rd Cl., and to be Temp. Lieut. whilst so employed; Mar. 6th.

**Memoranda.**—To be Temp. Lieuts.: Sub-Lieut. W. T. Gilson, from R.N.V.R., for duty with R.F.C.; Jan. 6th. Sub-Lieut. L. M. Goodyear, from R.N.D., for duty with R.F.C.; Mar. 1st. To be Temp. 2nd Lieuts.: A. E. Reynolds, for duty with R.F.C.; Jan. 26th. Actg.-Corpl. A. J. Evans, R.F.C., on Gen. List, for duty with R.F.C.; Mar. 9th. R. G. H. F. Beresford to be Temp. 2nd Lieut. (on prob.), for duty with R.F.C.; Mar. 9th.

## London Gazette Supplement, March 22nd.

The under-mentioned to be 2nd Lieuts. for service in the Field:—

**Somerset Light Infantry.**—Sergt.-Major J. Bullock, from R.F.C.; Feb. 20th, seniority Dec. 14th, and to be secd. for duty with the R.F.C.

**For duty with R.F.C.**—Actg. Sergt.-Major W. C. Hayward, from R.F.C.; Feb. 19th.

The under-mentioned to be Temp. 2nd Lieuts.:—

**For Duty with R.F.C.**—1st Cl. Air-Mech. F. Crompton, from R.F.C.; Feb. 7th. Corpl. R. C. Jenkins, from R.E.; Feb. 8th. Sergt. G. O. Smart, from R.F.C.; Feb. 21st. Sergt. R. G. Malcolm, from R.F.C.; Feb. 24th. Actg. Sergt. E. J. Briscoe, from L'pool. R.; Feb. 26th.

**Flight-Commander.**—Temp. Lieut. B. St. J. Boulbee, Gen. List, from a Flying Officer, and to be Temp. Capt. whilst so employed; Mar. 13th.

**Flying Officers.**—Temp. 2nd Lieut. S. Cockerell, Gen. List; Nov. 10th. 2nd Lieut. J. R. Taylor, Rif. Brig., and to be secd.; Jan. 29th. 2nd Lieut. G. C. Matthews, Australian L. Horse; Feb. 7th. Temp. Lieut. A. S. Travers, R. Muns. Fus., and to be transfd. to Gen. List; 2nd Lieut. R. M. Rankin, Sco. Rif., S.R., and to be secd.; Temp. 2nd Lieut. (on prob.) H. J. Scales, Worc. R., and to be transfd. to Gen. List; 2nd Lieut. J. B. Thomas, S.R. Feb. 10th. Temp. Lieut. C. McM. Laing, M.C., R. Sc. Fus.; 2nd Lieut. A. J. J. O'Farrell, E. Lan. R. (T.F.), and to be secd.; Feb. 28th. Temp. 2nd Lieut. F. Wright, attd. N. Staff. R., and to be transfd. to Gen. List; 2nd Lieut. E. F. Colman, S. Staff. R. (T.F.), and to be secd.; Temp. 2nd Lieut. A. B. Anstey, Gen. List; Temp. 2nd Lieut. (on prob.) R. S. Twigg, Gen. List, Temp. Capt. G. Ross-Soden, Gen. List, a Flying Officer, relinquishes the appointment of Wing Instructor in Gunnery (graded as a Flight-Com.), and reverts to the rank of Temp. 2nd Lieut.; Dec. 29th.

**Flying Officers (Observers).**—2nd Lieut. R. A. Raleigh, Lond. R. (T.F.), and to be secd.; Feb. 10th, seniority Sept. 28th. 2nd Lieut. J. Brodie, Cyclist Bn. (T.F.), and to be secd.; Feb. 25th, seniority Sept. 29th. 2nd Lieut. A. N. MacQueen, Gord. Highrs. (T.F.), and to be secd.; Feb. 28th, seniority Oct. 16th. Temp. 2nd Lieut. W. T. Gilson, Gen. List; Jan. 6th, seniority Oct. 29th. Temp. 2nd Lieut. (on prob.) C. Dixon, Gen. List; Feb. 25th, seniority Oct. 29th. Temp. 2nd Lieut. (on prob.) C. S. Goodfellow, Gen. List; Feb. 27th, seniority Oct. 29th. Feb. 28th: 2nd Lieut. (Temp. Lieut.) K. A. S. G. N. Fearnside-Speed, A.S.C., S.R., seniority Nov. 7th; Temp. 2nd Lieut. L. A. Norris, R.E., seniority Nov. 13th. Temp. 2nd Lieut. W. Wallace, Gen. List; Feb. 25th, seniority Nov. 13th. Temp. Lieut. E. B. Maule, High. L.I., and to be transfd. to Gen. List; Feb. 5th, seniority Nov. 14th. 2nd Lieut. W. Gray, Gord. Highrs., S.R., and to be secd.; Mar. 3rd, seniority Nov. 14th. Temp. 2nd Lieut. V. C. Morris, A. Cyclist Corps, and to be transfd. to Gen. List; Feb. 27th, seniority Nov. 18th. Temp. Lieut. G. W. Swann, A.S.C., and to be transfd. to Gen. List; Feb. 28th, seniority Nov. 19th. Temp. 2nd Lieut. (on prob.) F. M. Myers, M.C., Suff. R., and to be transfd. to Gen. List; Feb. 13th, seniority Nov. 23rd. Temp. 2nd Lieut. R. C. Doughty, Gen. List; Feb. 28th, seniority Nov. 28th. Temp. 2nd Lieut. (on prob.) W. K. Carse, Gen. List; Feb. 12th, seniority Dec. 9th. Temp. 2nd Lieut. (on prob.) H. L. Waddington, Gen. List; Feb. 28th, seniority Dec. 18th. Lieut. D. J. McRae, Can. Inf. Bn.; Jan. 31st, seniority Dec. 20th. Temp. 2nd Lieut. F. C. Elstob, attd. R. Fus., and to be transfd. to Gen. List; Feb. 25th, seniority Dec. 29th. Lieut. (now Capt.) W. A. Hannay, L'pool. R., and to be secd.; Feb. 14th, seniority Jan. 4th.

**Adjutants.**—Lieut. (Temp. Capt.) T. E. Longridge, A.S.C., and to retain his temp. rank whilst so employed, in succession to 2nd Lieut. (Temp. Capt.) B. E. Sutton, Yeo. (T.F.); June 23rd. (Substituted for the notification in the *Gazette* of July 22nd.) Lieut. H. French, W. York. R., S.R., from a Flying Officer (Ob.), vice 2nd Lieut. (Temp. Capt.) B. E. Sutton, Yeo. (T.F.); Sept. 27th. (Substituted for the notification in the *Gazette* of Oct. 27th.)

**Equipment Officer, 1st Class.**—Temp. Capt. R. F. Stapleton-Cotton, Gen. List, from the 2nd Cl.; Feb. 18th.

## Schools of Military Aeronautics.

**Assistant Commandant Staff Officer, 2nd Class (graded for pay as a Brigade Major).**—Lieut. (Temp. Capt.) C. S. McNab, Camn. Highrs., vice Lieut. (Temp. Capt.) S. W. Smith, R.A.; Feb. 22nd.

**Memoranda.**—Temp. Lieut. H. C. Lomer, from R.N.V.R., to be Temp. Capt. for duty with R.F.C.; Dec. 26th. Actg. Sergt.-Major J. C. McNamara, from R.F.C., to be 2nd Lieut. for duty with R.F.C.; Mar. 23rd. The under-mentioned Cadets to be Temp. 2nd Lieuts. (on prob.), for duty with R.F.C.:—Mar. 9th: F. A. Worlidge and F. L. Williams.

**Supplementary to Regular Corps.**—2nd Lieut. R. G. Fordham relinquishes his commission; Mar. 23rd. The under-mentioned 2nd Lieuts. (on prob.) are confirmed in their rank: W. S. C. Stephens, G. W. Armstrong, S. V. Green, D. Richardson, R. Waddell and J. B. Thomas. The under-mentioned to be 2nd Lieuts. (on prob.): S. B. Standen; Feb. 1st. Mar. 9th: C. D. Clarke, H. A. Scott, A. Dobson, T. A. Russell, H. K. Fairbrother, J. R. Sykes, A. L. Freeman, A. E. Rampton, E. P. Spriggs and A. W. B. Medhurst, A. L. Thomas; Mar. 12th.

## London Gazette, March 23rd.

**Special Appointment.**—Graded for pay as Staff Lieut., 3rd Cl.: Temp. 2nd Lieut. P. J. Carden, from R.F.C.; Feb. 19th.

**Wing-Commander.**—Capt. (Temp. Major) R. B. Martyn, M.C., Wilts. R. from a Sqdn. Com., and to be Temp. Lieut.-Col. whilst so employed; Dec. 31st.

**Flight-Commander.**—Lieut. (Temp. Capt.) S. W. Smith, R.A., from an Asst. Comdt.; Feb. 22nd, with seniority Dec. 7th, 1915.

**Flying Officers.**—Temp. 2nd Lieut. C. H. Adamson, R. Ir. Fus., and to be transfd. to Gen. List; Feb. 15th. Feb. 28th: 2nd Lieut. C. E. Saunders, Gord. Highrs. (T.F.), and to be secd.; 2nd Lieut. H. T. H. Unwin, Yeo. (T.F.), and to be secd.; Temp. 2nd Lieut. D. Coates, Gen. List; Temp. 2nd Lieut. (on prob.) A. C. Finlayson, Gen. List; Temp. Capt. N. Robertson, Norf. R., and to be transfd. to Gen. List; Temp. Lieut. H. W. Owen, Gen. List; Temp. 2nd Lieut. W. S. Philcox, Gen. List; Temp. 2nd Lieut. G. J. E. Smith, Gen. List; Temp. 2nd Lieut. M. M. Kaizer, Gen. List; 2nd Lieut. E. P. Watson, R.W. Surr. R., and to be secd.; Temp. 2nd Lieut. A. J. Chapman, Gen. List. Mar. 1st: Temp. Lieut. W. J. Rees, R. W. Fus., and to be transfd. to Gen. List; Temp. 2nd Lieut. T. C. Thomson, attd. R. W. Kent R., and to be transfd. to Gen. List; 2nd Lieut. G. L. Percy, Lan. Fus., S.R., and to be secd.; Temp. Lieut. D. M. Goodyear, Gen. List; Temp. 2nd Lieut. G. M. Lewis, R.W.

Surr. R., and to be transfd. to Gen. List. Mar. 2nd: Temp. 2nd Lieut. J. Ferguson, Gen. List; 2nd Lieut. F. Sadler, Durh. L.I. (T.F.), and to be secd. Mar. 3rd: 2nd Lieut. B. E. Edwards, Lan. Fus. (T.F.), and to be secd.; 2nd Lieut. (on prob.) W. B. Wood, Hamps. R. (T.F.), and to be secd.; Mar. 7th. Temp. 2nd Lieut. W. Woodward, Gen. List; Temp. 2nd Lieut. A. B. Cort, Gen. List. The seniority of Temp. 2nd Lieut. (Temp. Lieut.) J. L. M. de C. Hughes-Chamberlain, Gen. List, is Dec. 14th, 1915, and not as stated in the *Gazette* of Oct. 7th, 1916. The seniority of Temp. Lieut. R. A. Walmisley, Gen. List, is Feb. 25th, 1916, and not as stated in the *Gazette* of Mar. 9th, 1917.

**Equipment Officers, 2nd Class.**—2nd Lieut. (on prob.) (Temp. Hon. Lieut.) A. B. D. Lang, Spec. Res., relinquishes his temp. hon. rank, and to be Temp. Lieut. whilst so empld.; 12th Feb. Capt. H. W. France, Lond. R. (T.F.), and to be secd.; 3rd Mar.

**3rd Class.**—2nd Lieut. (on prob.) A. W. Chapman, Spec. Res.; 27th Dec. 2nd Lieut. P. M. Thesiger, Yeo. (T.F.), and to be secd.; 1st Feb. 2nd Lieut. (on prob.) H. Fuller-Clark, Spec. Res.; 2nd Feb. 2nd Lieut. R. Waddell, Spec. Res.; 18th Feb. Temp. 2nd Lieut. (on prob.) A. A. M. Weir, Gen. List; 23rd Feb. Temp. 2nd Lieut. C. H. Tancred, Gen. List, from a Flying Officer; 28th Feb. Temp. 2nd Lieut. B. W. A. Greenough, M.C., Shrops. L.I., and to be transfd. to Gen. List; 1st Mar. and Lieut. D. Richardson, Spec. Res.; 3rd Mar.

**Memoranda.**—Sub-Lieut. H. W. Owen, from R.N.V.R., to be Temp. Lieut. for duty with R.F.C.; Feb. 28th. Lieut. F. S. Thomas from R.N.V.R., to be Temp. 2nd Lieut. (on prob.) for duty with R.F.C.; Mar. 15th.

## London Gazette Supplement, March 24th.

### Attached to Headquarters Units.

**Draft Conducting Officers (graded for pay as Staff Lieutenants, 2nd Class).**—Temp. 2nd Lieut. F. Crisp, from R.F.C.; Feb. 13th.

**Squadron Commanders.**—From Flight Coms., and to be Temp. Majors whilst so employed: Lieut. (Temp. Capt.) A. J. L. Scott, Suss. Yeo. (T.F.); Mar. 6th. Capt. A. G. Moore, M.C., Manch. R., S.R.; Mar. 23rd.

**Flight-Commanders.**—Major A. S. W. Dore, Worc. R. (T.F.), from a Flying Officer; Mar. 6th. From Flying Officers, and to be Temp. Capts. whilst so employed: 2nd Lieut. (Temp. Lieut.) W. S. Caster, Cyclist Bn. (T.F.); Mar. 13th. Lieut. P. F. J. Kent, D. Gds.; Mar. 18th.

**Flying Officers.**—Temp. Capt. H. C. Lomer, Gen. List; Dec. 26th. Temp. Lieut. H. R. Clarke, A.S.C., and to be transfd. to Gen. List; Mar. 1st. Mar. 3rd: Temp. Lieut. R. H. Sharp, attd. Worc. R., and to be transfd. to Gen. List; Temp. 2nd Lieut. W. R. Fish, Suff. R., and to be transfd. to Gen. List. Mar. 4th: Temp. Lieut. D. C. Telford, R.E.; 2nd Lieut. A. E. Scott, Lond. R. (T.F.), and to be secd.; 2nd Lieut. P. J. Wood, R.W. Surr. R. (T.F.), and to be secd.; 2nd Lieut. F. W. Crawford, Lond. R. (T.F.), and to be secd. The seniority of 2nd Lieut. (Temp. Lieut.) A. W. Smith, L'pool. R. (T.F.), is Jan. 22nd, 1916, and not as stated in the *Gazette* of Mar. 3rd. The seniority of Temp. 2nd Lieut. W. G. Barker, M.C., Gen. List, is April 7th, and not as stated in the *Gazette* of Mar. 6th.

**Park Commander.**—Qr.-Mr. and Hon. Lieut. (Temp. Capt.) W. J. D. Pryce, R.F.C., from an Equipment Officer, 1st Cl., and to be Temp. Major whilst so employed; Feb. 2nd.

**Equipment Officer, 3rd Class.**—Temp. 2nd Lieut. A. Pollock, Gen. List; Mar. 10th.

**Memoranda.**—To be Temp. 2nd Lieuts. (on prob.): J. G. Barron, for duty with R.F.C.; Mar. 6th. Sergt. H. E. Went, from R.F.C., for duty with R.F.C.; Mar. 10th.

**Supplementary to Regular Corps.**—2nd Lieut. (on prob.) J. D. Inglis resigns his commission; Mar. 25th.

## London Gazette Supplement, March 26th.

**Squadron Commander.**—Capt. (Temp. Major) T. G. Hetherington, Hrs., from a Sqdn. Com., R.N.A.S., and to retain his temp. rank whilst so employed; Feb. 22nd, with seniority from May 27th, 1915.

**Flight-Commanders.**—Lieut. (Temp. Major) A. C. Wright, S.R., to revert from Sqdn. Com. to Flight-Com., to relinquish his temp. rank, and to be Temp. Capt. whilst so employed; Mar. 8th, with seniority Nov. 13th, 1915. From Flying Officers, and to be Temp. Capts. whilst so employed: Lieut. F. Billinge, Manch. R., S.R.; Mar. 11th. Lieut. A. F. Baker, D. of Corn. L.I., S.R.; Mar. 12th. Temp. 2nd Lieut. F. T. Courtney, Gen. List; Mar. 14th. 2nd Lieut. F. L. J. Shirley, York. R.; Mar. 15th.

**Flying Officers.**—2nd Lieut. (Temp. Lieut.) F. A. Bates, Yeo. (T.F.), and to be secd.; Feb. 13th. Feb. 27th: Temp. 2nd Lieut. (on prob.) C. P. Williams, Gen. List; 2nd Lieut. D. C. Birch, North'n. R., and to be secd. 2nd Lieut. E. R. Rudling, R. W. Surr. R. (T.F.), and to be secd.; Feb. 28th. Lieut. J. H. Brink, R.F.A., S.R.; Mar. 1st. Mar. 2nd: Lieut. H. T. F. Russell, R.W. Fus. (T.F.), and to be secd.; 2nd Lieut. (Temp. Lieut.) H. C. Cutler, Yeo. (T.F.), and to be secd.; 2nd Lieut. (on prob.) A. J. Brown, R. Suss. R. (T.F.), from K. R. Rif. C., and to be secd.; 2nd Lieut. J. D. Payne, Gen. List. The date of the appointment of Capt. G. E. F. Sutton, M.C., Can. Inf. Bn., is Feb. 15th, with seniority from Jan. 19th, 1916, and not as stated in the *Gazette* of Mar. 8th. The date of seniority of Lieut. G. W. Devenish, R.A., is April 20th, 1916, and not as in the *Gazette* of Nov. 14th, 1916. The date of seniority of Lieut. K. MacKenzie, Sea. Highrs., S.R., is April 15th, 1916, and not as stated in the *Gazette* of Jan. 19th. The date of seniority of 2nd Lieut. C. Turner, Worc. R., is Feb. 22nd, 1916, and not as stated in the *Gazette* of Feb. 21st. Lieut. (now Temp. Major) C. Hirtzel, S.R., and to be Temp. Capt. whilst so employed, from Jan. 17th to 31st.

**Equipment Officers, 1st Class.**—Mar. 8th: Temp. 2nd Lieut. H. Cumming, Gen. List, from a Staff Lieut., and to be Temp. Capt. whilst so employed; Temp. Capt. J. Romanes, Bord. R., and to be transfd. to Gen. List; Temp. Lieut. G. E. Stagg, Gen. List, from a Staff Lieut., and to be Temp. Capt. whilst so employed; Lieut. (Temp. Capt.) G. Dugdale, Yeo. (T.F.), from a Staff Lieut., and to retain his temp. rank whilst so employed; 2nd Lieut. N. Martin, S.R., from the 3rd Cl., and to be Temp. Capt. whilst so employed.

**2nd Class.**—Mar. 8th: 2nd Lieut. D. W. Wilson, S.R., from the 3rd Cl., and to be Temp. Lieut. whilst so employed; 2nd Lieut. (Temp. Capt.) P. C. A. Bridgeman, A.S.C. (T.F.), to retain his temp. rank whilst so employed, and to be secd.; Temp. Capt. P. E. Tinkler, North'n. Fus., and to be transfd. to Gen. List. From the 3rd Cl.: 2nd Lieut. P. Adams, S.R., and to be Temp. Lieut. whilst so employed; 2nd Lieut. (Temp. Lieut.) D. Hodgson, Cyclist Bn. (T.F.), and to retain his temp. rank whilst so employed; 2nd Lieut. (on prob.) A. W. Chapman, S.R., and to be Temp. Lieut. whilst so employed; Qr.-Mr. and Hon. Lieut. D. McBirney, R.F.C., and to be Temp. Lieut. whilst so employed.

**3rd Class.**—Mar. 8th: 2nd Lieut. D. L. Abbott, Lond. R. (T.F.), and to be secd.; Temp. 2nd Lieut. J. G. Spencer, E. Kent R., and to be transfd. to Gen. List. 2nd Lieut. (on prob.) W. T. Hanson, S.R.; Mar. 12th.

**Memoranda.**—Sub-Lieut. M. J. Thurston, from R.N.V.R., to be Temp. Lieut. for duty with R.F.C.; Mar. 2nd.

**Supplementary to Regular Corps.**—2nd Lieut. (on prob.) T. L. Baylis resigns his commission; Mar. 27th.



## AIRCRAFT WORK AT THE FRONT.

## OFFICIAL INFORMATION.

**British.***War Office, March 14th.*

"*Mesopotamia.*—Our cavalry pushed forward in pursuit, and after slight resistance occupied Kadhmain, capturing over 100 prisoners and four damaged aeroplanes."

*General Headquarters, March 16th.*

"A number of reconnaissances were carried out with success yesterday by our aeroplanes, and several fights took place in the air, in the course of which four German machines were destroyed and three others driven down damaged."

*General Headquarters, March 17th.*

"An encounter took place yesterday between a patrol of eight of our aeroplanes and 16 enemy machines. As a result of 20 minutes' fighting the hostile formation was broken up, two German aeroplanes were destroyed, and two others were driven down damaged. All our machines returned."

*General Headquarters, March 18th.*

"There was a great activity in the air yesterday, and a number of large enemy formations were engaged by our machines and dispersed. In the course of the fighting seven hostile aeroplanes were brought down and nine others driven down damaged. Eight of our machines are missing."

*General Headquarters, March 19th.*

"Our aeroplanes did much valuable work yesterday in co-operation with our infantry. The enemy's troops were engaged successfully with machine guns, and bombs were dropped on a number of places behind his lines. In air fights one German was destroyed, and one driven down, damaged. Two of our aeroplanes are missing."

*General Headquarters, March 20th.*

"Bombs were dropped yesterday by our aeroplanes, with good results, on an important enemy munition depot. In air fights one German machine was brought down in flames, and two others were driven down completely out of control. Three of our aeroplanes are missing, two of which are known to have been brought down by hostile anti-aircraft guns."

*General Headquarters, March 22nd.*

"Our aeroplanes were active again yesterday in the area of the enemy's withdrawal, and much valuable reconnaissance work was carried out. One German machine was brought down behind our lines."

*War Office, March 24th.*

"*Salonica.*—Our aircraft have made many bombing attacks on enemy concentrations and communications, and during the week have accounted for four enemy machines."

**French.***Paris, March 17th.*

"During yesterday our chaserplanes were particularly active. Numerous engagements were fought by our pilots, in the course of which eight enemy machines were brought down. Three of these machines were brought down by Captain Guynemer and fell in flames within our lines. These bring up to 34 the number of German machines brought down by this officer up to the present. Lieut. Doullin also brought down within our lines yesterday his 12th machine. A ninth machine, struck by our anti-aircraft guns, came crashing to the ground in the region of Corbeny."

"During the night of March 16th-17th our air squadrons bombarded the enemy organisations in the region of Arnville and the blast furnaces and factories of Völklingen, where a great conflagration was observed, as well as the stations and roads of the region of Ham and St. Quentin. All our machines returned unscathed."

"As a reprisal for the enemy's setting fire to Bapaume one of our aeroplanes to-day bombarded the town of Frankfurt-on-Main."

*Paris, March 18th.*

"In the course of yesterday, Captain Guynemer brought down his 35th enemy aeroplane, and Captain Doumer his sixth. Two other enemy machines attacked by our pilots crashed to the ground—one north of Cerny-en-Laonnais and the other east of Roye."

"According to further information, a 10th aeroplane which fell near Chavonnes has to be added to the nine German aeroplanes brought down by us on the 16th."

"Two German aeroplanes were brought down to-day by the fire of our anti-aircraft guns. One of them fell near Virginy (Marne) and the other to the west of Brimont (Reims district.)"

*Paris, March 19th.*

"Yesterday Warrant Officer Madon attacked at very close quarters and brought down his eighth German aeroplane. On the same day another enemy machine, after a fight with one of our pilots, came crashing to the ground west of Alt-

kirch. It is confirmed that another German aeroplane was brought down last Saturday north of Cerny-en-Laonnais. On Saturday evening, and during the night of Saturday and Sunday, our air squadrons bombarded the factories and foundries of Thionville and the Briey basin, and convoys and enemy troops on the march in the region of Guiscard."

*Paris, March 20th.*

"One of the German aeroplanes which were reported as destroyed on March 17th, was brought down by Warrant Officer Douchy. This is the fifth machine felled up to now by this pilot. Yesterday two German machines were brought down in our lines in the course of air fights, one in the region of Noyon and the other in the direction of Guiscard. Moreover a German machine which was attacked with a machine-gun by one of our pilots on March 16th was discovered yesterday by our troops near Noyon. It is also confirmed that on the same day (March 16th) our anti-aircraft guns brought down a German aeroplane in the region of Manheulles."

*Paris, March 23rd.*

"Yesterday an Albatros chaser was brought down in our lines in the region of Vezelise."

"To-day a German aeroplane was brought down by our anti-aircraft guns. The machine fell in our lines near Dieulouard."

*Paris, March 24th.*

"On the 23rd Adjutant Ortoli brought down his fifth German aeroplane. To-day our anti-aircraft guns brought down an enemy machine, which fell in our lines near La Neuve."

"This afternoon a German seaplane, going towards Etretat, was captured at sea. The two airmen were taken prisoner."

"On March 23rd one of our aeroplanes bombarded at a low range the aerodrome of Marimbois, to the north of Thiaucourt. A violent fire broke out in the sheds, which collapsed."

"During the night March 22nd-23rd and the following night our squadrons dropped 1,100 kilogrammes of projectiles on the factories of Thionville and the Briey Basin, as well as on the station of Conflans."

*Paris, March 25th.*

"Yesterday Warrant Officer Ortoli brought down his sixth German machine. Another enemy aeroplane was brought down in the region of Bois Fontaines."

"German aeroplanes yesterday evening dropped several bombs on Calais and Dunkirk. At Dunkirk there were no victims, and no damage was done. At Calais two civilians were killed and one was wounded."

**Russian.***Petrograd, March 15th.*

"Enemy aeroplanes dropped over 60 bombs on Radziviloff Station."

*Petrograd, March 18th.*

"In the region south-west of Riga bombs were dropped by a Zeppelin."

**Italian.***Rome, March 14th.*

"Enemy aircraft dropped bombs on Gorizia, causing a few casualties among the inhabitants."

**Serbian.***Salonica, March 14th.*

"The enemy aviators have again bombarded the field hospitals at Vertekop, and caused victims among the sick and medical staff. Two English nurses have been killed. The hospitals at Vetekop are completely separated from the other camps, and distinctly marked with the signs of the Red Cross. It is evident that the enemy bombarded them intentionally."

**Roumanian.***Jassy, March 13th.*

"In the Braila region two of our battleplanes engaged and brought down two enemy aeroplanes, which fell in flames."

**German.***Berlin, March 13th.*

"*Macedonia.*—Bomb attacks by our air squadrons on the railway station of Vertekop, south-east of Vodena, secured hits, causing fires to break out, which were seen to burn for a long time."

*Berlin, March 17th.*

"Our aviators, by means of an aerial attack, brought down in flames four enemy captive balloons."

*Berlin, March 18th.*

"From the coast as far as the Oise the clear weather resulted in increased aerial activity. The enemy lost 19 aeroplanes in aerial encounters and three by anti-aircraft fire. Lieut. Baron von Richthofen shot down his 27th and 28th opponents. Lieut. Baltamus defeated his 14th and 15th opponents. We lost three aeroplanes."



## THE NEW SECRETARY OF THE AERONAUTICAL SOCIETY.

THE new Secretary of the Aeronautical Society, Mr. W. Barnard Faraday, bears a name famous in the annals of scientific research. Born in Manchester in 1874, he is the son of Mr. F. J. Faraday, who was for 30 years financial editor of the *Manchester Guardian*, and is a great-nephew of the late Professor Michael Faraday, F.R.S.

Educationally, Mr. Faraday's career has been a varied one. After completing a full course in mechanical and electrical

work on the law of patents and monopolies. Called to the Bar in 1900, he was elected to the Northern Circuit, and achieved some celebrity as a lecturer and writer on economic subjects, and became a Fellow of the Royal Statistical Society.

Early in the present war he joined the Army as a Second Lieutenant in the 5th Battn. of the York and Lancaster Regiment, and was invalided out of the service last year.



Mr. W. Barnard Faraday, the new Secretary of the Aeronautical Society of Great Britain. This photograph was taken in the old offices of the Society in Adam Street, Adelphi, on the day that their headquarters were removed to more suitable premises in Albemarle Street.

engineering at the Manchester School of Technology, he was apprenticed to Messrs. Brooks and Doxey. Apparently he was not particularly attracted by practical engineering, for after his indentures were completed he betook himself to the study of law, and graduated LL.B., with 1st class honours, at the Victoria University in 1897. Pursuing the study of law, he gained the Lee Prize at Gray's Inn for research

Then, after leaving the Army, he took up an appointment under the Ministry of Munitions, which appointment he vacated to become Secretary to the Aeronautical Society. During the course of a busy life Mr. Faraday has held several university and other appointments, and among other things has been a Town Councillor for Stockport, and District Scoutmaster in Devonshire.

## SIDE-WINDS.

FROM the editor of the *Joy Stick* comes the first typographical number of that little publication, the *House Journal* of A. V. Roe and Co., Ltd. The present production is really the fourth number of Vol. 1, the three previous issues having been merely duplicated folders with which the producers desired to "feel" the situation before proceeding to full-blown type.

It seems now to have become quite the vogue, and rightly so, that large aeroplane works, employing thousands of workers, should each have their own *House Journal*, for no doubt these chatty periodicals do an immense amount of good by creating a sort of "family" atmosphere, thereby keeping prominent the much-desired understanding that the welfare of the firm is also the welfare of the employees. In choosing the inscription "Avro Milestones" for the heading of the account of the firm's work, the editor has continued a happy inspiration originated, when dealing with some Avro productions, in the pages of "FLIGHT." Indeed, the Brothers Roe may honestly claim to have erected milestones along the whole road of aviation, right from the machine that was the first aeroplane to leave the ground in England, up to the present time.

The editor of the *Joy Stick* wishes it known that he will be pleased to exchange his journal every fortnight, now it is printed, for the *House Journal* of any other concern interested, and also with those units of the Services running their own little organs.

We wish this latest addition to aviatic house journalism every success.

OWING to the depletion of their staff, the Rotax Motor Accessories Co., Ltd., have had to temporarily close their Manchester depot, 291-293, Deansgate, and all correspondence and goods should therefore be addressed to their head-

quarters, Rotax Works, Willesden Junction, N.W. This is a war measure simply, and the depot will be re-opened immediately after the war.

ONE of the manufacturing trades that must have experienced increased activity since the opening of the war is that of the Bifurcated Rivet Co., Ltd., of Aylesbury, and Upper Thames Street. Not only must the, probably, thousands of miles of extra belting now in use in this country call for a stock of these trusty rivets being kept ready for mending breaks, and for shortening stretched belts, but the company have introduced many things of considerable importance used in aeroplane construction proper. There are, to mention but two items, the eyelets in brass, nickel, and aluminium, and the very handy and neat little turn buttons for use in fixing engine-housing and such purposes. A post-card to the company's London address will bring an illustrated catalogue wherein may be found a full range of their specialities pertaining to the industry.

THE employees of the Selsdon Aero and Engineering Co. demonstrated their notions of food economy pretty emphatically by choosing this year a concert in place of the usual annual dinner. This entertainment was held on Saturday, March 24th, at the "Swan and Sugarloaf" Hotel, Croydon, and proved a great success. The twenty or so items on the programme included songs, glees, the comic element, violin solos, and a vote of thanks to the chairman, Mr. R. Brown, the whole concert being entirely provided by inside talent, whilst the vote was supported very heartily by the entire assembly of workers. None of the gentler sex were present, by which you shall guess that the aroma of the weed that soothes was much in evidence. The girls, however, will make amends later with a whist drive and dance, to the



latter part of which, we presume, the men will be admitted, even if only on sufferance, and as a heaping up of coals upon them for their ungallant conduct at their own function. Out of the proceedings permanent good has resulted, as Mr. Campling, managing director, has very kindly offered to

provide a piano for the works recreation room, to encourage and develop the musical talent of the employees, so that next year, which we hope may be one of peace, should find the extraordinary talent so recently discovered, in an even more perfect state.

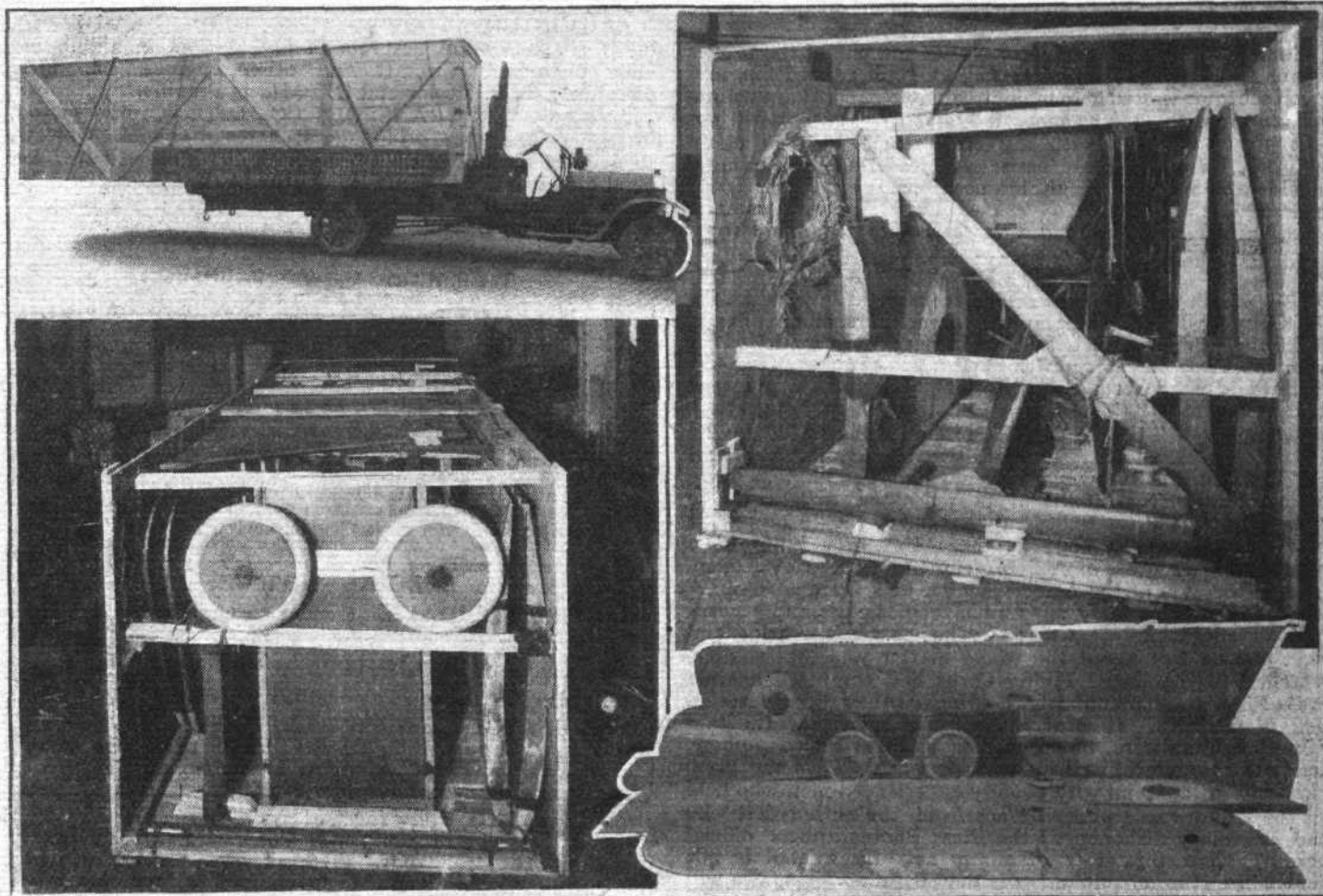
### PACKING-CASES.

WHEN I was detailed to go round to the Lep Transport, Ltd., case makers, packers, and shipping agents, and see how packing-cases are made, I hardly foresaw much of an interesting nature to enthuse upon. Those who have had little to do with packing-cases are likely to imagine a case as just a few boards nailed together. But they are mistaken; the business of case making is one almost beyond the uninitiated's powers of description. I have seen, from time to time, the huge cases in which motor cars and aeroplanes are packed for transport, and a little thought should have revealed to me that such things must of necessity be something more than my preconceived notion of their manufacture.

pint pot. The case only seemed about one half the size of the carriage, yet there it was, with seemingly all the parts sitting in each other's laps.

Carriages, motor cars, furniture, engines, all the hundred and one items continually going over-seas, have formed the daily tide that has flown out of Castle Street, Long Acre, for many years, and now the present activity in aviation has added the huge cases to contain aeroplanes, in which direction the Lep Transportation are exceedingly expert, and, therefore, very busy.

As to the actual manufacture, it appears to rest principally upon the expertness of skilled workmen (almost cabinet-



A group of photographs showing the methods of the Lep Co. in packing aeroplanes. In the lower right photograph an aeroplane is seen dismantled ready for packing.

Packing-cases have to be strong. They are going to contain a heavy load which is going to be sent to any one of the four corners of the world. They are going to be loaded on wagons, slung aboard ship, lowered and packed away in holds, only to be hauled out again somewhere or other and loaded on to trains, and they must be built to withstand all this and protect their valuable contents. Then there is the distribution of weight, and the planning of the position of the strengthening supports, so that when the giant crane lifts the load, the case will remain firm and square to its original shape, and not go squeaking and groaning into some other shape, thereby disorganising the packing of the contents, to their natural depreciation. Packing-case making is not the easy job most of us take it to be. Each is separately planned, and some are so large that one would almost consider it the work of an architect to measure up and get out the plans.

Cubic capacity has to be seriously considered. Space is a valuable thing on board ship, and so these cases are made to take their various merchandise snugly and securely in position, in a way that is truly marvellous.

I saw at the Lep Packing Depository a case containing a carriage going somewhere abroad, that almost disputed the old adage that it is impossible to get a quart of liquid into a

makers); suitable, but not necessarily large, machinery, running tackle, and plenty of floor space on which the erections can take place. Two large buildings, of five floors each, provide the latter, and the output seems to be limited only by the amount of man-labour available.

During a chat with the manager, the company's foresight could be plainly seen in placing themselves in such a position that they are able to obtain the necessary timber under favourable conditions with regard to quality and constant delivery. Quality is a big consideration, for it is possible that during the actual transportation, some of these cases may have to stand out in the rain for some little time. Therefore, although they are all made with tongued and grooved boards, whitelead in between, it is necessary that the timber should be well-seasoned stuff.

Aeroplane manufacturers, indeed all those requiring cases in which goods may be sent abroad, would do well to get into communication with the Lep Company at Castle Street, Long Acre, W.C., and state their requirements, for they are undoubtedly artists in their own particular line, and, as such, must be in a position to help materially in the worrying business of how to get heavy or bulky articles to their far-away destinations.



# CORRESPONDENCE.

**Wanted Employment Agency for Wounded Airmen.**  
[1933] The number of wounded flying men that are crippled for life is daily increasing. Does it not seem to you that some kind of institute is wanted to assist in obtaining employment for such men, who have lost a leg or an arm in the service of their King and Country, so that they could work in one special department?

In the case of "Observers" also, the wounded are equally helpless. I am sure I can find at least £100 towards starting such an institute. I know it is very difficult work to find employment for cripples at any time, and not inviting to most people, but it is certain that after the war enthusiasm has blown over, these poor flying men will have a very difficult time.

As I have been severely wounded myself, and laid crippled in the hospital for many months, I have seen a number of pitiful cases. My accident came from a German torpedo, and the shattering of the limbs is exactly the same as the flying man. I believe I was blown up into the air and fell down on the deck. Strangely enough, I was on aeroplane work at the time.

Your position in the industry makes you one of the proper organs to establish such an agency as I am advocating, and if you see your way to help in your valuable paper, I am willing to found it with £100 as suggested, and I feel sure it will not lack good support; with my connections with so many factories, I am sure I can assist you materially in finding a considerable number of suitable positions.

JOHN LAWSON.

70, Vauxhall Bridge Road, London, S.W., Mar. 22nd, 1917.

## "The Lie Direct."

[1934] (In regard to the recent accusations levelled at the R.F.C. by the Press Photographers' Association, and the denial of the allegations by the R.F.C., we have received the following from the Press Secretary of the P.P.A.):—

It would seem from the editorial paragraphs in a recent issue of "FLIGHT" that the Press Photographers' Association, in being given "the lie direct," has metaphorically put its foot into it. Let it rather be said that we have put both feet in "it," and find the going very much to our liking. There is something of the intelligent as well as the artistic in the make-up of the Press Photographer, and it should be patent that so important a body as the P.P.A. would not have stepped into a morass of misrepresentation with its eyes open. Indeed, the eyes of the Association are at "Open Aperture," and saw to it that there was ample proof, before any accusations or allegations were made. The most aggravating and most serious fact about the whole matter was that soldiers attached to the Royal Flying Corps had competed against Press Photographers unfairly, holding, as they did, a reservation of facilities. It is also worthy of note that the said valiant fighters were, in pre-war days, Press Photographers, and were, therefore, well up to their work. Thus the Press men had to contend with equally experienced men who held all the trump cards under licence from the authorities, who had grievously dishonoured the Press Photographers' official permit. That this state of affairs actually existed is not denied by the champions of the R.F.C. Thus, we will assume that the lie direct refers to the statement that the photographs thus taken were submitted to the Press. The P.P.A. made a bald statement of fact concerning this, and that statement is adhered to. We hold absolutely undeniable, uncontrovertible proof that pictures were sent to the Press and that some of them were actually published. Thus, the lie is thrown back at the R.F.C. champion; the P.P.A. stands to its guns, and sticks to its accusations; moreover, it is prepared to make a boomerang of any other "lies direct" which may come along.

The Press Photographers' Association shares with the rest of the community a whole-hearted and grateful admiration for that part of the R.F.C. which lives up to its name, but views with contempt actions which have besmirched the name, fame and reputation of a Corps which has produced such a galaxy of heroes.

It is not our province to criticise the policy of the military authority which finds it to the national weal to employ able-bodied soldiers on civilian tasks, but it is our province to look to the interests of the Press Photographer, and it is with this object in view, that we have stated a case.

If the photographic section of the R.F.C. is to continue the game, let their soldier photographers have a distinct motto rather than that which graces the real R.F.C.

I would suggest "Cucullas non facit monachum."

L. H. C.

26-29, Poppin's Court, Fleet Street, E.C., March 26th.

# COMPANY MATTERS.

## Vickers, Ltd.

THE directors of Vickers, Ltd., announce that, under the existing circumstances, it has not yet been possible to present the accounts for the year ended December 31st, 1915, and that the accounts for the year ended December 31st, 1916, must be necessarily also delayed. In the meantime it has been arranged that the final dividend for the year 1916 of 2½ per cent. on the preferred 5 per cent. stock and on the 5 per cent. preference shares will be paid on the 31st inst.

## Sunbeam Motor Car Co., Ltd.

THE directors of the Sunbeam Motor Car Co., Ltd., have declared an interim dividend of 5 per cent. on the ordinary shares, free of income tax, payable on April 14th.

## NEW COMPANIES REGISTERED.

**AERO STATIONS, LTD.**—Capital £10,000, in 8,000 ordinary shares of £1 each and 40,000 deferred shares of 1s. each. Under agreement with Brighton-Shoreham Aerodrome, Ltd.

**ALUMINIUM ALLOY PISTONS, LTD.**—Capital £2,000, in £1 shares. Manufacturers of and dealers in aluminium alloy pistons for aircraft and other engines, &c. First directors: T. F. Taylor and G. P. H. de Freville.

**AVIO MOTOR TRANSPORT CO., LTD.**—Capital £1,500, in 1,480 ordinary and 20 founders' shares of £1 each. Objects, to acquire motor vehicles, aeroplanes, seaplanes, ships, &c. First directors: T. Adams, A. Britton, A. E. Crates, W. J. W. Cook, A. Farrell, E. Horder, F. G. Hazel, R. J. Watkins and B. Wild, all of Bristol.

■ ■ ■ ■

## Aeronautical Patents Published.

Applied for in 1915.

Published March 29th, 1917.

- 16,734. J. ADAMS. Aerial warfare, &c.
- 16,791. I. F. TAYLOR, and S. PICK. Aerial apparatus for defence against hostile aircraft.
- 16,894. C. R. WITTEMANN. Aeroplanes.

Applied for in 1916.

The numbers in brackets are those under which the Specifications will be printed and abridged, &c.

Published March 29th, 1917.

- 583. C. A. JOHANSSON. Stabilisation of aircraft. (104,346.)
- 3,166. MARCONI'S WIRELESS TELEGRAPH CO. and H. M. DOWSETT. Aeroplanes fitted with wireless telegraph apparatus. (104,386.)
- 3,400. J. E. POLLAK. Aerial incendiary or explosive mines. (104,393.)

## SPECIAL NOTICE.

**EASTER HOLIDAYS.**—Owing to the fact that Good Friday falls in next week, it is necessary for the next issue of "FLIGHT" to close for press on Monday, April 2nd. All copy, Editorial or Advertisement, must therefore be at the Office, 44, St. Martin's Lane, W.C. 2, not later than the first post on Monday morning.

## Index and Title Page for Vol. VIII.

The 8-page Index for Vol. VIII of "Flight" (January to December, 1916) is now ready, and can be obtained from the Publishers, 44, St. Martin's Lane, W.C., Price 6d. per copy, post free.

If you require anything pertaining to aviation, study "FLIGHT'S" Buyers' Guide and Trade Directory, which appears in our advertisement pages each week.

## FLIGHT.

44, ST. MARTIN'S LANE, LONDON, W.C.  
Telegraphic address: Truditur, London.  
Telephone: 1828 Gerrard.

## SUBSCRIPTION RATES.

"FLIGHT" will be forwarded, post free, at the following rates:—

UNITED KINGDOM.			ABROAD.		
	s.	d.		s.	d.
3 Months, Post Free..	3	10	3 Months, Post Free	5	0
6 " " " "	7	7	6 " " " "	10	0
12 " " " "	15	2	12 " " " "	20	0

Cheques and Post Office Orders should be made payable to the Proprietors of "FLIGHT," 44, St. Martin's Lane, W.C., and crossed London County and Westminster Bank, otherwise no responsibility will be accepted.

Should any difficulty be experienced in procuring "FLIGHT" from local news-vendors, intending readers can obtain each issue direct from the Publishing Office, by forwarding remittance as above.